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TOOL & DIE JOURNAL

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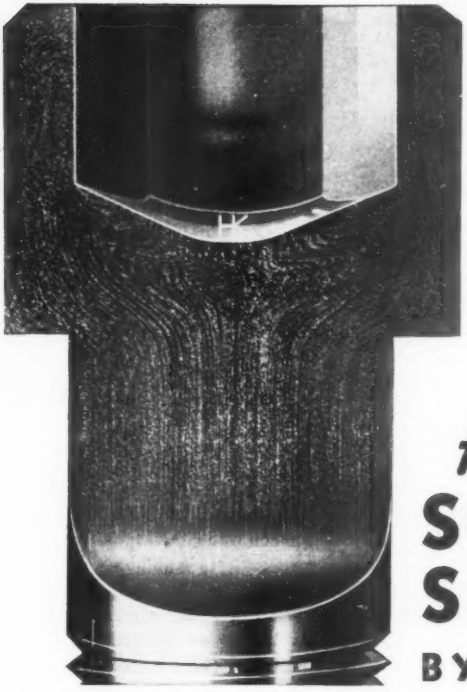

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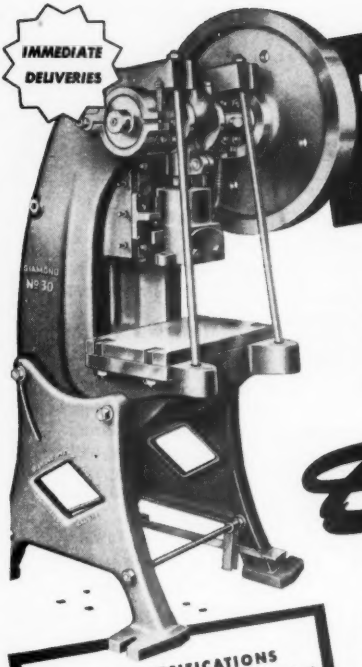

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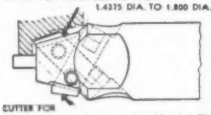

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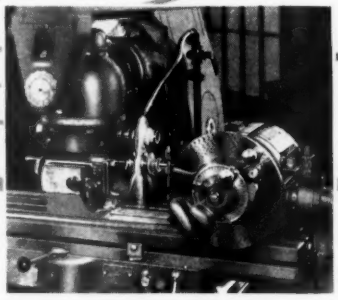

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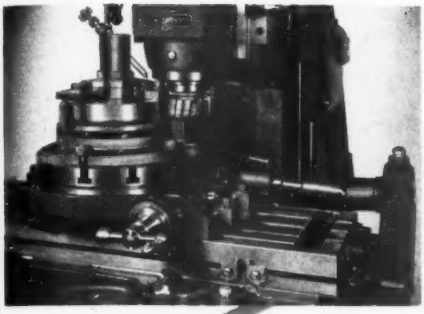
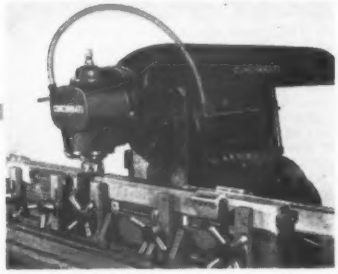


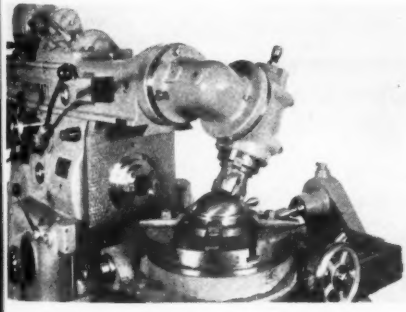
Left: Circular Milling Attachment with power feed drive. For circular milling operations. May also be tooled up for continuous milling. 16", 20" and 24" sizes available.

● Here are six of the thirty-five different standard milling attachments offered by CINCINNATI to simplify tooling; improve methods; handle a different type of operation; raise quality; lower unit costs; step up production; minimize equipment costs. Attachments may be purchased with machines or as an afterthought—i.e., most of them are not "built-in" but may be obtained as the need arises. ¶ All types and styles of CINCINNATI Milling Attachments are illustrated and described briefly in attachment circular M-1382-1. Write for your copy.

Above: Milling a fixture part held in a No. 5 Plain Vise. Vise jaws may readily be changed to special designs suitable for the work. Swivel, Toolmaker, and All-Steel Vises also available.



Above: Heavy Vertical Milling Attachment. Does the work of a vertical machine. Spindle head may be swiveled 45° right and left.



Left: Motor Driven Universal Milling Overarm Attachment on a CINCINNATI Dial Type. Always ready to use; convenient for frequent changes in setups.

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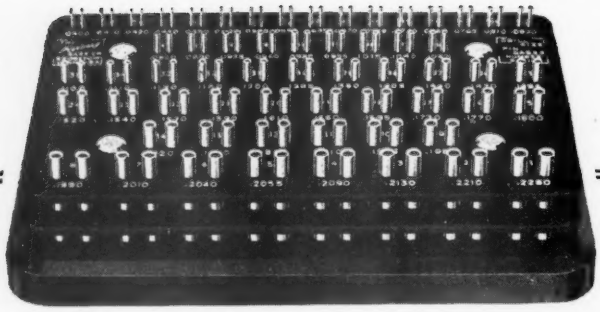

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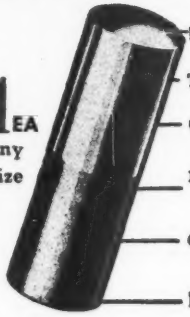

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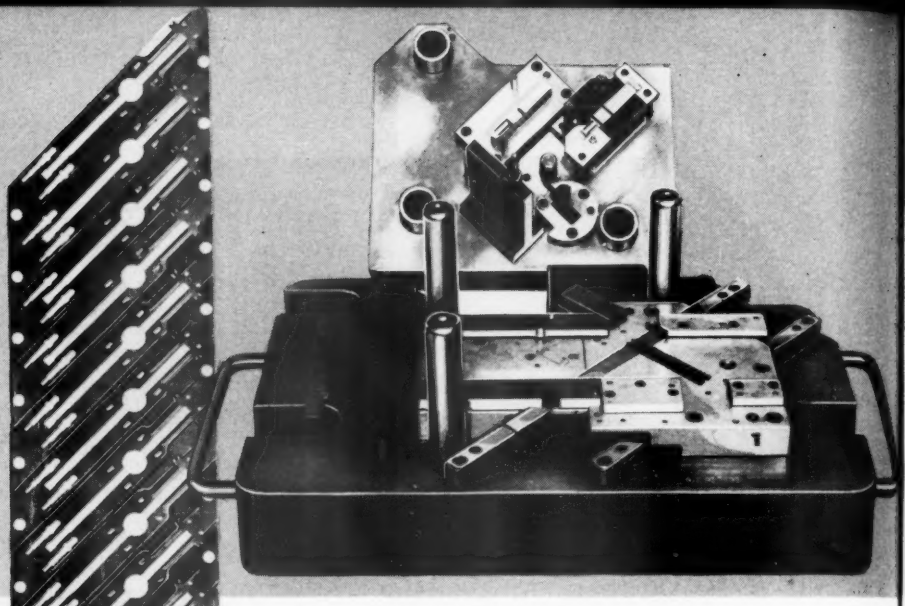

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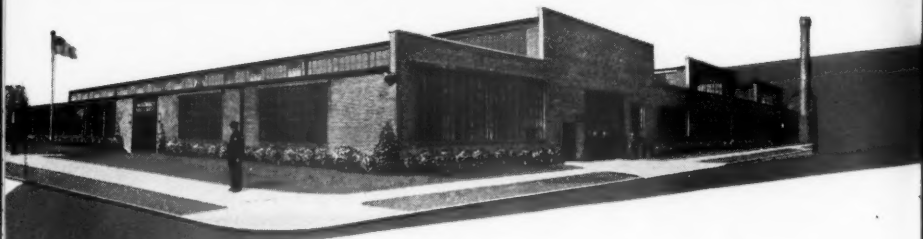

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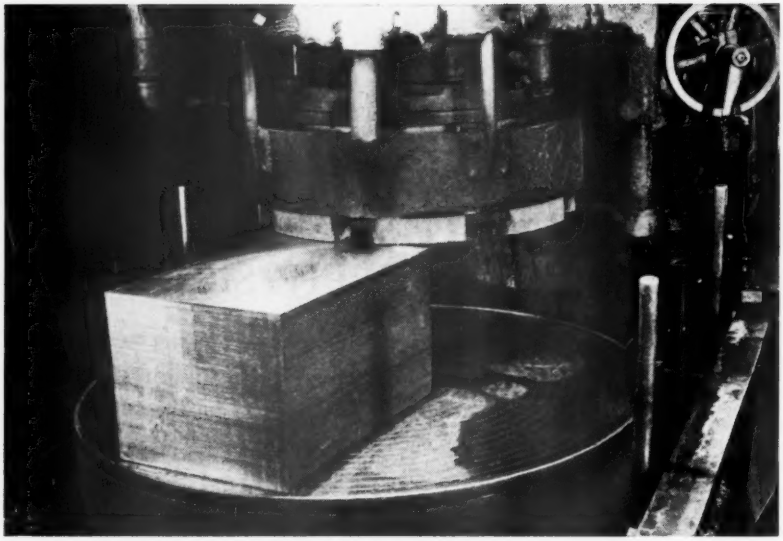

Segment Life Doubled . . . Grinding Time Cut Over an Hour with the Sensational 32 ALUNDUM*

IN the plant of one of the largest producers of die castings they grind vanadium steel impression blocks on a Blanchard surface grinder removing about $\frac{3}{32}$" of scale and $\frac{1}{32}$" of steel on each side. Segment life had been about three days per set.

When they changed to segments of the new 32 ALUNDUM abrasive (32A24-F12VBEP) life jumped to *six days* per set and they save 1¼ hours grinding time on each block 24 x 24 x 6". And they report that the 32 ALUNDUM segments are cooler cutting, too.

It's on just the types of grinding jobs found in tool and die shops— surfacing, tool and internal—that 32 ALUNDUM wheels are making their most sensational records. Have you tried them?

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Good news for production men! You can get quick delivery from stock of Super Carbide Tipped Milling Cutters designed especially for cutting cast iron. Available in all standard sizes, these cutters incorporate up-to-the-minute design improvements that cut costs, speed production and improve finishes. For the extra toughness and efficiency of carbide tipped mills plus the advantages of Super Tool engineering and design combined with surprisingly low prices . . . specify SUPER Carbide Tipped Milling Cutters . . . and see the difference!

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ARE *Engineered* FOR THE JOB

Proper selection of drills will enable you to produce better work *faster* and at lower cost. Special jobs call for Special Purpose Drills which have been developed to meet certain specific requirements. ✧ One example is found in the photo below showing a set-up of 148 Burner Drills. Their short flutes and sturdy construction make them ideally suited to overcome the difficulties of drilling castings of this kind. ✧ Send for your copy of new, illustrated booklet describing these and other Special Purpose Drills.

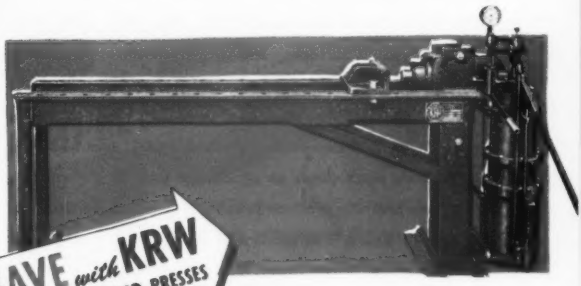
Save 3 ways with...

KRW ARBOR PRESSES

SAVE with KRW
HAND-OPERATED PRESSES

1

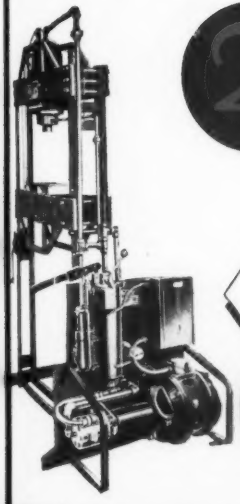
You name the job, and we'll name the KRW Press best fitted to do it better, faster, and at lower cost. Take KRW Hand-operated presses for example: they give more power with less effort...combining faster ram travel with a quick-acting finger controlled valve that makes the KRW Press outstanding in efficient hydraulic action. Twin pumps enable operator to vary ram speed. The special "Capstan" type handwheel brings the ram to the work fast as well as providing a "built-in" mechanical press for the lighter jobs. 30 days delivery guaranteed. Write for prices and catalog.



2

SAVE with KRW
AIR-OIL OPERATED PRESSES

KRW Hydraulic Presses equipped with our "Speedi-Booster" operate on compressed air, providing tons of pressure at the ram by effortlessly raising or lowering the operating lever. In operation, compressed air enters an air cylinder, the piston of which drives the smaller hydraulic oil piston which, in turn, forces the oil under pressure to the large cylinder piston. Tonnage pressures are dependent upon initial air pressure and size of air and oil cylinders. 30 days delivery.



SAVE with KRW
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3

Here is a self-contained power unit that drives KRW Hydraulic Presses. These units can be purchased separately to drive any existing KRW Press. The KRW Motor Driven Hydraulic Presses are low-cost, production units ideally suited for short runs or small work. Presses are equipped with Seco Radial type pumps in capacities ranging from 3,000 to 10,000 PSI. Guaranteed by both the manufacturer and K. R. Wilson. Write for prices.

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for Longer Life of Parts, Fewer Rejects, Use the Sunnen Precision Honing Machine on Internal Diameters from .125" to 2.625"

In your production shop, tool and die shop, or maintenance department there may be dozens of applications where you can improve the service life of parts that need straight, true, accurate holes. By using the Sunnen Precision Honing Machine on these jobs you can be sure of accurate fitting, smooth surfaces, and close tolerances that mean longer life, and smoother operation at low cost.

The accuracy produced by the Sunnen Precision Honing Machine is guaranteed to be within .0001" and has often been held much closer on production jobs. It is a versatile machine and will produce practically any commercial finish you may desire. This machine produces a true hole—free of bell-mouth, wave, taper, high spots or tool marks.

In addition, the Sunnen Precision Honing Machine operates in any metal, plastic or ceramic material except lead and babbitt—can be easily and quickly set up—is easy to operate, skilled labor is not required—maintains alignment between two holes—duplicates sizes easily—is low in cost and economical to operate.

For complete details, write for free bulletin, Form No. XSP5000, or ask a Sunnen engineer to call and show you how Sunnen Honing can be applied to your internal finishing jobs.

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SUNNEN

187

Typical Jobs

Universal bearing honed to 10 micro inch finish gives longer service.

Line reamer bushings, diameter 2.375", accuracy held to .0001".

Miniature aircraft cylinder—smooth, accurate honing provides better compression and longer life.

Automobile Distributor Shaft Gears. Taper removed at a rate of 80-90 per hour.

Compressor Yoke. Alignment maintained and better finish produced.

A Solution to

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With GORTON and Tracer Control

THIS JOB IS COMPLETELY AUTOMATIC

This duplicate Milling and Indexing job was accomplished with a standard Gorton Pantograph with special fixtures—just one of many possibilities of tracer control milling.

Gorton Tracer Controlled equipment includes duplicators, pantographs and electric arc etchers for milling, engraving, etching and many other metal removal operations. This equipment provides high spindle speeds, wide versatility and high precision—characteristics for which Gorton has been known for more than fifty years. It will pay you to investigate Gorton Tracer Control methods now.

Standard Gorton Tracer Controlled 3-U Pantograph with special fixtures profiles turbine impeller blades in one completely automatic cycle

THE JOB IN BRIEF

Name of Part—Turbine Impeller
Qty. 1 to 3
Material—Aluminum alloy.
Machine—Gorton Tracer Controlled 3-U Pantograph with special fixtures.
Operation—Mill 30 impeller blades in machined aluminum alloy blank with completely automatic feed and indexing.
Actual Cutting Time—1 minute per blade; 30 minutes per impeller.
Cutting Tools—.038" single flute cutter.
Remarks—Shape of cut determined by motorized master which drives the tracing stylus. Feed of cutter governed by special cam interlocked with indexing arrangement.

12¼" O. D.

Gorton Pre-Determines Results for You

Send us complete description with prints of your job. Our Engineering Department will send you a production estimate on the same job tooled on Gorton Tracer Controlled equipment—no obligation.

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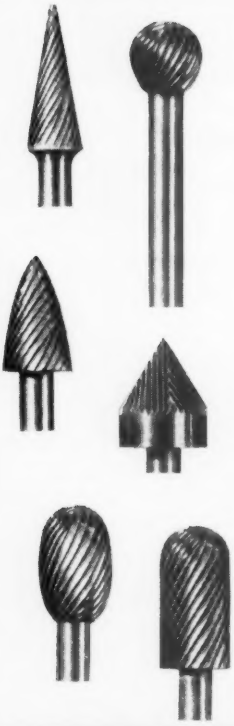
1A

KOOL-KOTE

Only DANLY Standard and Tool and Die Makers' Rotary Files are Kool-Koted for longer life—



• Danly Kool-Kote Rotary files cut at speeds and on hardened die steel where no other similar tools will perform. The Kool-Koted process lends an amazing toughness to the outer surface which gives these tools up to 500% longer life.

A special flute ground continuing across the top of the radius leaves no ragged tooth ends to scratch or mar.

Our Tool & Die Makers' Tools are ground 30-teeth per inch for semi-finish work and 50-teeth per inch for finish work right up to final touch-up. Write for folder giving details and prices.

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Danly Die Sets and Die Makers' Supplies Speed Production

in the Die Shop

in the Press Room

DANLY PRECISION DOWEL PINS are accurate through their entire length . . . Diamond tested for hardness (58-60 Rockwell-C) . . . Ground to a tolerance of .0001".

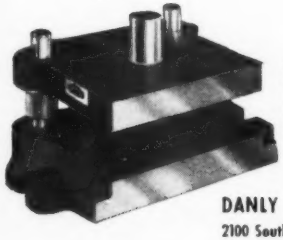
DANLY KNURLED SOCKET-HEAD CAP SCREWS save time and money. The mechanic can drive the knurled head a good part of the way before using the wrench. Infinite applications—a wide range of sizes.

Photo—Courtesy of Croname, Inc.

DANLY KWIK-KLAMP TOGGLE CLAMPS combine strong construction and simplicity of operation—used wherever quick, positive clamping action is required.

DANLY DIE SPRINGS are noted for staying power and high resistance to fatigue. Two complete lines: *Medium Pressure—High Deflection; High Pressure—Medium Deflection.*

DANLY SOCKET-HEAD STRIPPER BOLTS. Made of high-grade steel, these stripper bolts have the same knurled socket-head found in Danly Cap Screws.



DANLY DIE SETS are famed for precision and known accuracy in Die Shops and Stamping Plants everywhere. Many types and sizes in Steel, and Semi-Steel.

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Combined with its accessories and exclusive attachments, the Handee Tool performs more operations with greater accuracy than any other portable electric tool at any price.

PRECISION ATTACHMENTS. Fit Handee only. Offhand carving, routing, shaping is exact as to depth of cut, accuracy of line. Indispensable to pattern shop. Set of 6, postpaid, $7.95

HANDEE KIT Strong, compact steel carrying case holds the Handee Tool and a complete assortment of accessories. Postpaid, $27.50. Handee with 7 accessories only, $20.50

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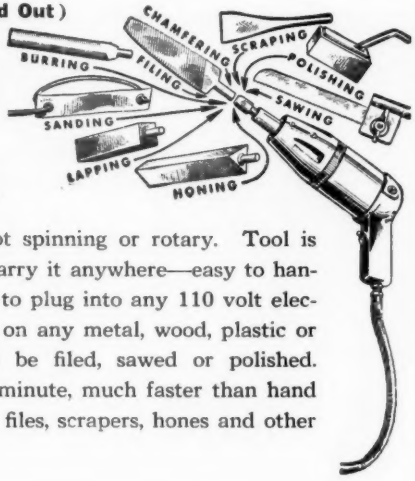
TOOLS *for* PRECISION PRODUCTION

Reciprocating Action (In and Out)

PORTABLE
Electric
RECIPROCATING TOOL



Motion is "in and out" not spinning or rotary. Tool is portable—light weight— carry it anywhere—easy to handle. Self contained. Ready to plug into any 110 volt electric outlet. Use it to work on any metal, wood, plastic or other materials that may be filed, sawed or polished. Delivers 1000 strokes per minute, much faster than hand methods. Complete line of files, scrapers, hones and other accessories available.

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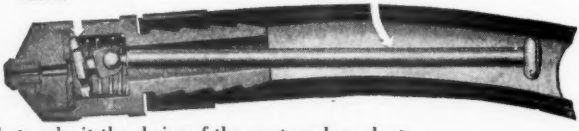
Valve completely enclosed. Eliminates Packing Glands.

Slight movement of lever gives complete discharge.



Features that make it the choice of the most modern plants—

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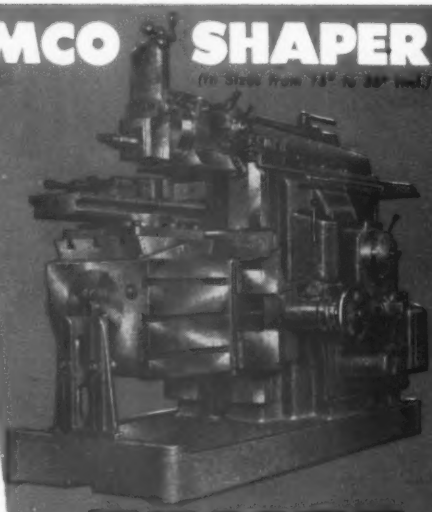
YOU TOO CAN DO THE JOB BETTER

ON A **GEMCO SHAPER**

(In Sizes From 12" to 36" Stroke)



* **THESE 7 USERS TELL YOU WHY...**

1. "GEMCO downfeed of head, fingertip touch of traverse, and the Lubrigard Safety features, are perfect."
2. "GEMCO SHAPERS cut the machining time on our motor yokes 25%."
3. "Whenever we have a particularly difficult job to do, we always do it on a GEMCO."
4. "GEMCO is a mighty good Shaper, easy to handle, rugged, and accurate even on a maximum stroke."
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6. "Our GEMCO Shaper has proved its worth many times over."
7. "We've had our GEMCO Shaper a year, and our tool makers are still enthusiastic about it."

*EXCERPTS FROM TYPICAL LETTERS IN OUR FILES.

GEMCO

Multi-Purpose SHAPERS

Shown above is the Universal Type GEMCO Shaper. It is ideal for tool and die work, or for angular set-ups. Embodying the exclusive Lubrigard Safety Feature, its life for precision operation is unlimited.

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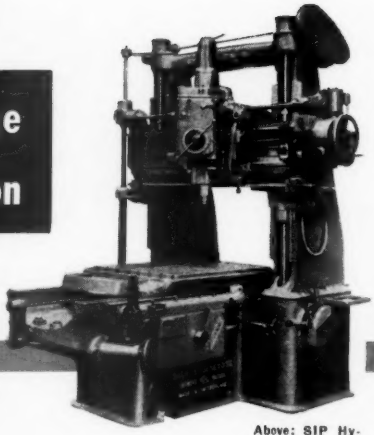
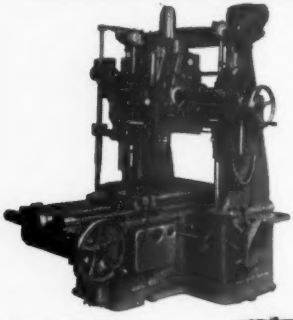
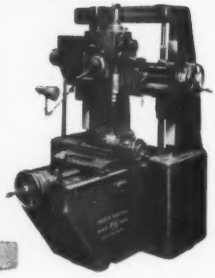


Above: SIP Hydroptic B Jig Boring and Milling Machine. Table size 39½" x 32". Guaranteed accuracy for all settings of work table and spindle head 0.0002".

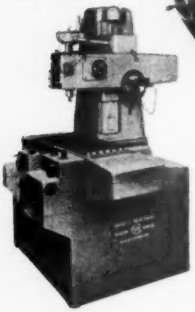


Above: SIP No. 4G Jig Borer. Table size, 27½" x 23⅝". Direct readings to 0.00005".

Right: SIP No. 3K Jig Borer with table 21½" x 15". Direct readings to 0.00005".



Below: MP-2H guarantees all settings to 0.00015". Table size 27½" x 12½".



JIG BORERS

American manufacturers who must have the ultimate in precision machining may now obtain all the advantages of famed Swiss workmanship by selecting SIP Jig Borers. Exceptional precision, sturdiness of construction and time-saving features of setup and operation insure dependable operation over a wide range of work. The Hydroptic-B Jig Boring and Milling Machine (illustrated above) is equipped with a built-in optical measuring system which is completely protected and entirely free from mechanical stress. This advantageous feature has also been employed in the smaller SIP Jig Borer No. 2H (bottom illustration). Each of the complete line of SIP Jig Borers is capable of producing work of exceptional precision, and each is so dependable in operation that it is not only a metal-working machine, but also a measuring instrument of unquestioned accuracy. We represent in the United States the following Swiss manufacturers: Societe Genevoise d'Instruments de Physique (SIP), Andre Bechler, Mikron, Safag, Studer, Sallaz, Schaublin, Lienhard. With these lines to choose from, we can give expert advice in selecting the correct Swiss Machine Tools and Measuring Instruments for every job.

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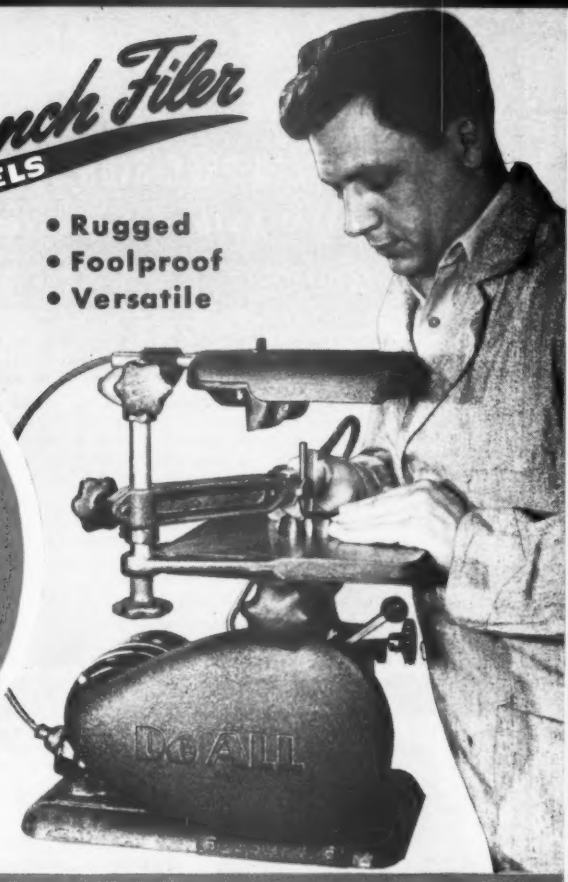
HIGH PRECISION MACHINE TOOLS AND MEASURING INSTRUMENTS

DoALL Precision Bench Filer

2 MODELS

- Rugged
- Foolproof
- Versatile



Ideal for Dies! · · · Perfectly Straight Strokes! · · · No Corrective Hand Filing!

What It Does—Finishes intricate corners too small for band filing. Files, saws and hones with perfectly straight strokes due to special universal-joint file clamp, instantly adjustable to give vertical movement in true axial line of file, regardless of twists or inaccuracies of file shanks. Fine, accurate results without resorting to corrective hand filing. Adjustable roller on overarm supports upper end of file and helps to maintain true alignment under work pressure. Work hold-down also on overarm.

What It Includes—Large model (No. FH-10) takes ⅛" to ⅜" tool shanks, has 10⅜" square tilting table, 1½" stroke. Illuminated magnifier over work. Flexible chip blower. Hand lever for 90° table register. Precision table-tile adjustment. Small model (No. FH-1) takes ⅛" to ¼" shanks, has 8¼" square tilting table, ¾" stroke. Both models have instant adjustment of vertical shaft bearings from outside. Scotch yoke mechanism runs in oil bath in sealed housing; oil level always visible through sight gage.

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DoALL Products Include

Contour Saws • Saw Bands • Band and Jig Filers • Files and File Bands Surface Grinders • Grinding Wheels Form Dressers • Cutting Oils • Radius Shaper-Miller • Lathes • Profilers Variable Speed Units • Tool Steel Layout Ink, etc.

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SPRINGFIELD PRECISION TOOL ROOM LATHE

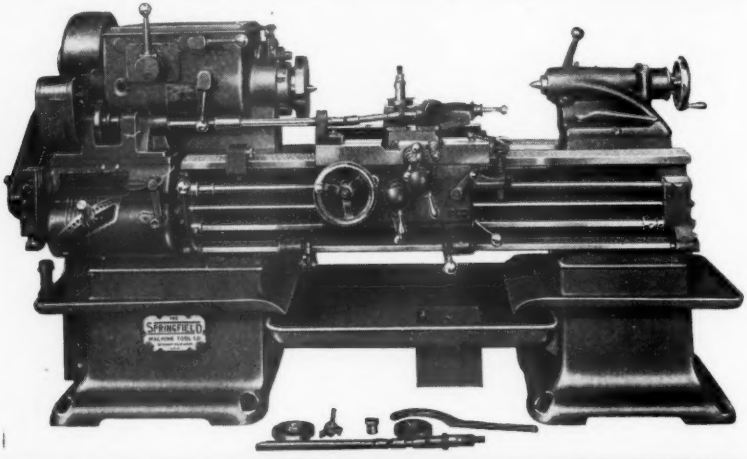
"A Master Lathe for Master Craftsmen"

The Springfield Precision Tool Room Lathe is engineered and constructed to the most exacting requirements. Its superior design features have been developed through more than sixty years' experience in building precision machine tools.

The powerful Headstock provides twelve spindle speeds. No more than seven of its chrome Molybdenum hardened *ground* gears are in mesh at one time. Timken Precision Taper Roller Bearings in solid headstock housings insure permanency of spindle alignment and long life. All bearings and gears are spray lubricated by cooled oil from the large reservoir in the leg.

The semi-steel Apron is of extra-heavy, box construction and is completely ball and bronze bearing-equipped. The Taper Attachment is capable of very fine, micrometer screw adjustment. The sturdy Compound Rest is a heavy duty, square base type providing full 360° swivel. The Tailstock, massively designed, has large centers and exceptionally long spindle travel.

ASK US FOR *YOUR* COPY OF BULLETIN 162 which illustrates and describes the features of the Springfield Precision Tool Room Lathe and gives detailed specifications.



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SPRINGFIELD • OHIO, U. S. A.

A Section of the Midwest Designing Department.

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A DESIGNING & ENGINEERING SERVICE

. . . with a background of Precision workmanship that is unsurpassed—anywhere! Our experienced designing and engineering department offers a complete service to handle any requirement from original design and blueprints to production procedure.

Are your production costs in line with today's competition?

Is your press tooling reduced to the minimum number of operations?

Are your products designed for streamlined production.

Midwest asks these questions because they are important to you, and because anything but an affirmative answer should demand immediate action. Examine your production facilities and available manpower—here you should find that maximum profit is being returned on total production. There is usually a chance for improvement—Midwest Tool & Engineering Co. has the staff of skilled engineers and designers who will inspect your plant and products with an aim to creating a satisfying affirmative answer to these questions.

The modern Midwest plant is completely equipped to handle the recommendations and final designs of their engineering department. Tools, dies, jigs, fixtures and special machines, designed to fit your particular job, can be manufactured by us with excellence of workmanship based on precision designing and engineering. An inspection by you of our complete tooling service will pay you big dividends!

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The American industrial system itself has required the independent special machine, tool and die shop to expand. It is called upon to render precision service to industry—to maintain and accelerate the output to meet widely fluctuating demand.

Bunell has adjusted to meet this challenge. We believe that it costs less to employ the services of Bunell—a shop that has adequate and flexible machinery, highly competent personnel and long experience.

Industrial management has found that it is a sound and profitable operation to have Bunell engineers handle specialized industrial machinery.

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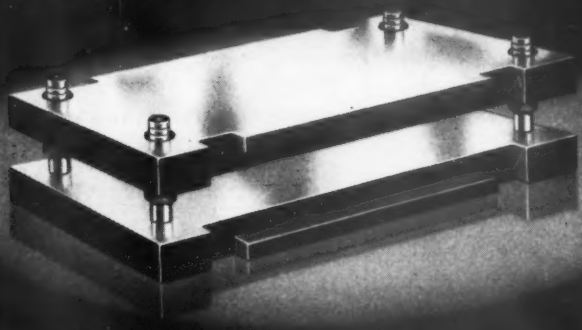

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DETROIT DIE SET CORPORATION

2895 W. GRAND BLVD. • DETROIT 2, MICHIGAN

DETROIT DIE SETS ★

Hot-Work Dies Hard-Faced with HAYNES STELLITE Alloy

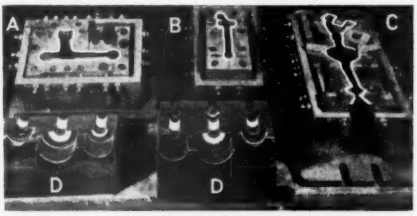
Outlasted Ordinary Dies from 3 to 6 times

HAYNES STELLITE hard-facing alloy greatly increased the life of these hot-work dies because it resists abrasive wear and retains its high hardness even at red heat.

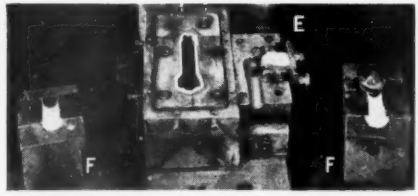
In addition, maintenance costs were reduced because dies had to be changed less frequently . . . and also because hard-faced dies could be repaired in half the time required to replace plain steel dies.

HAYNES STELLITE alloy is being used profitably in practically every industry. To decrease maintenance work . . . to reduce shutdown time . . . to maintain production . . . take full advantage of hard-facing. There is a HAYNES rod for every type of application. Write for the 104-page booklet, "Hard-Facing with Haynes Stellite Products."

Here's how hard-facing helped a large motor manufacturer . . .



	No. of Pieces Between Refittings	Hours Required to Refit Die
A—Hot-Trimming Die for Wheel Support	Steel—2,500 Hard-Faced—7,500	Steel—16 Hard-Faced—8
B—Hot-Trimming Die for Steering Crank	Steel—1,750 Hard-Faced—7,500	Steel—16 Hard-Faced—8
C—Hot-Trimming Die for Front Wheel Support Arm	Steel—2,500 Hard-Faced—7,500	Steel—40 Hard-Faced—20
D—Upsetting Die for Pinion Gear	Steel—5,000 Hard-Faced—25,000	Steel—40 Hard-Faced—70



E—Hot-Trimming Die for Steering Cross Shaft	Steel—3,500 Hard-Faced—15,000	Steel—28 Hard-Faced—10
F—Upsetting Die for Pinion Gear	Steel—3,500 Hard-Faced—25,000	Steel—28 Hard-Faced—70

HAYNES STELLITE COMPANY
Unit of Union Carbide and Carbon Corporation
UCC
General Offices and Works, Kokomo, Indiana
Chicago—Cleveland—Detroit—Houston—Los Angeles—
New York—San Francisco—Tulsa

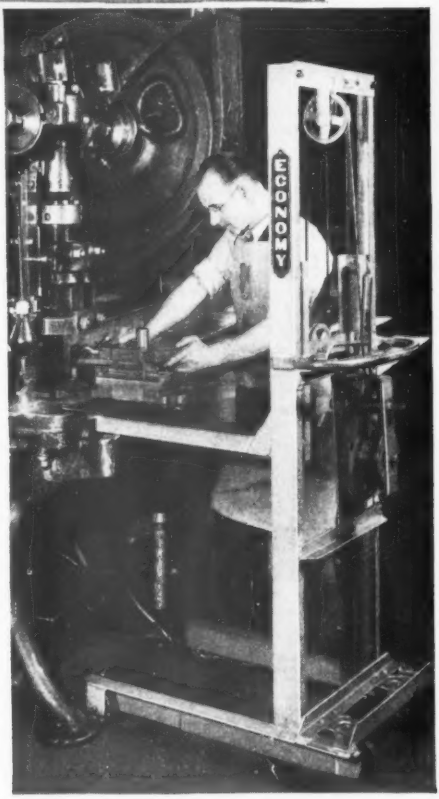
HAYNES TRADE-MARK *alloys*

The registered trade-marks "Haynes" and "Haynes Stellite" distinguish products of Haynes Stellite Company.

Save production time with a SHOPLIFTER

- **Light, Compact**
- **Easily Moved About**
- **One-Man Operated**
- **Wide Range in Application**
- **Saves Production Time**

  In handling dies and heavy fixtures; stacking barrels, boxes, etc.; loading and unloading trucks



Specifications

Type—D
Capacity—500 lbs.
Overall height—72"
Platform lift—54" above floor level, lowers to within 5" of floor
Baseframe—24" wide x 33" long
Platform—24" x 24", steel plate
Entire frame of machine of structural steel, electrically arc welded throughout
Basewheels—4" diameter, iron wheels
Crank up and down hoist unit
Two swivel casters and two stationary wheels with push bar furnished
Painted olive green finish
Weight—250 lbs. (approx.)

Heavier capacities up to 5,000 lbs. also available. Write for details.

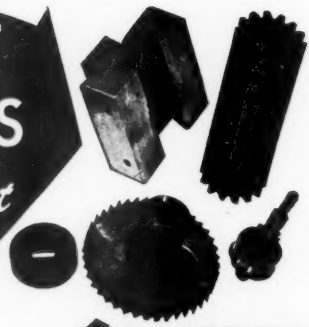
Prompt Delivery . . . Price* $157.50 *Full freight allowed

Foot Operated Floor Lock—$10.00 extra

ECONOMY ENGINEERING CO., 2659 W. Van Buren St., Chicago 12, Illinois

HEAT TREAT SMALL PARTS

In Your Own Plant



SAVE TIME AND MONEY

With these Versatile Cooley Furnaces

- One model to operate to 2000° F.
- One model, 2 sizes, to heat to 1850° F.
- Use for both hardening and tempering.
- Simple and economical to operate.
- Positive control over high and low heats.
- Uniform temperatures assure results.

Power Cost Less Than 4 Cents per Hour

To hold 1600° F. in the MH-3 furnace requires less than 2 kw. At power rate of 2c per kw.-hr., operating cost is under 4c per hour. Cooley furnaces are easily installed —ready for immediate service by connection power lines to two terminals. Replaceable heating elements are embedded in refractory materials, protecting against atmospheric attack. Quiet in operation—no fumes or odors—no ventilating necessary—they can be located at any convenient place in the shop.

ESSENTIAL FOR TOOL AND DIE SHOPS

More Profitable Reasons for Using Cooley Furnaces

1. Hardening, drawing and tempering small batches.
2. Small parts can be normalized and annealed quickly and easily.
3. Convenient for high speed pre-heating.
4. Expedites emergency repairs.
5. Use as a pilot furnace to pre-determine production heat-treating technique.
6. Harden and draw in the same furnace with assured temperature control at either heat.

TWO NEW OPTIONAL FEATURES AVAILABLE

1. Counter Weighted Vertical Lift Door conserves heat where door need not be fully opened. Replaces hinged hearth door at $20.00 additional on MH-3, MH-4—standard on MH-5.

2. Heavy Gauge Steel Stand—For ease of installation and operation—locates furnace at most convenient operating height and provides additional working and storage space. Add $35.00 to regular price.

THREE SIZES—MH-3, MH-4—1850° F. MH-5—2000° F.

Type	Chamber Capacity	Amps 115 V	Watts	Amps 230 V	Price
MH-3	8″W 6″H 14″L	29.6	3400	14.8	$146.00*
MH-4	10″W 6″H 18″L	.....	4500	19.6	$222.50*
MH-5	8″W 6″H 14″L	.....	4800	20.9	$340.00*

*All furnaces complete with Hearth Plate.

Automatic Control—Indicating Controlling Pyrometer—Thermo-couple and lead wire—approximately $150.00

FREE!

HEAT TREATING HELP

Our experience in heat-treating is available to you. State your problem . . . write for Bulletin No. 56 today—no obligation. No salesman will call.

COOLEY ELECTRIC MANUFACTURING CORP.

32 South Shelby Street Indianapolis 7, Indiana

INDIANAPOLIS MACHINERY EXPORT CORP.

Export Manager, 44 Whitehall Street, New York, New York

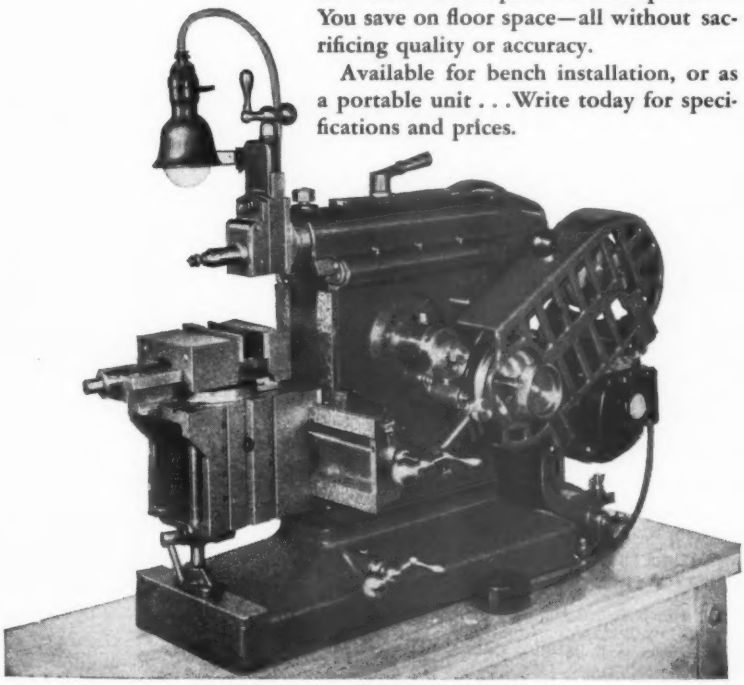
AMMCO

7″ SHAPER --*A precision machine meets postwar needs for accuracy, speed and economy*

If your production costs are going up, and your profit margin is getting less and less (and whose isn't)—consider what the Ammco 7″ Shaper can do for you.

The accuracy of work turned out on an Ammco 7″ Shaper assures precision production unsurpassed by larger machines selling for hundreds of dollars more than the Ammco . . . In addition to low initial cost, you also effect big savings in time and expense on set-up operations . . . You save on electrical power consumption . . . You save on floor space—all without sacrificing quality or accuracy.

Available for bench installation, or as a portable unit . . . Write today for specifications and prices.



AMMCO TOOLS, INC.

COMMONWEALTH AVENUE — NORTH CHICAGO ILLINOIS

(Formerly Automotive Maintenance Machinery Co.)

PRECISION CENTERED EYE BENDING

with

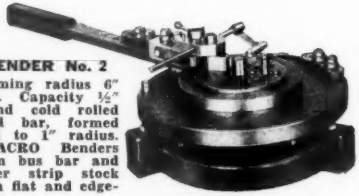
DI-ACRO BENDERS

A Centered EYE in 1 Operation

The DI-ACRO Bender makes perfectly centered eyes from rod or strip stock at a high rate of production. Both eye and centering bend are formed with one operation. Any size eye may be formed within capacity of bender and ductile limits of material.

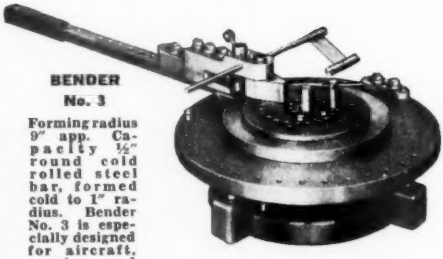
BENDER No. 1

Forming radius 2" app. Capacity 7/32" round cold rolled steel bar or equivalent. All DI-ACRO Benders have two-way action, right or left hand mounting and reversible forming nose.



BENDER No. 2

Forming radius 6" app. Capacity ½" round cold rolled steel bar, formed cold to 1" radius. DI-ACRO Benders form bus bar and other strip stock both flat and edgewise.



BENDER No. 3

Forming radius 9" app. Capacity ½" round cold rolled steel bar, formed cold to 1" radius. Bender No. 3 is especially designed for aircraft, marine and other large radius bending.

DI-ACRO IS PRONOUNCED "DIE-ACK-RO"

DI-ACRO bending is accurate to .001" for duplicated parts. DI-ACRO Benders bend angle, channel, rod, tubing, wire, molding, strip stock, etc. Machines are easily adjustable for simple, compound and reverse bends of varying radii.

Send for Catalog "DIE-LESS" DUPLICATING

showing many kinds of "DIE-LESS DUPLICATING" produced with DI-ACRO Benders, Brakes and Shears.

DI-ACRO PRECISION MACHINES DIE-LESS DUPLICATING

O'NEIL-IRWIN MFG. CO.

315 Eighth Ave.
Lake City, Minn.

ALLEN Socket Head Cap Screws

ALLEN HEAD used as jig and fixture feet

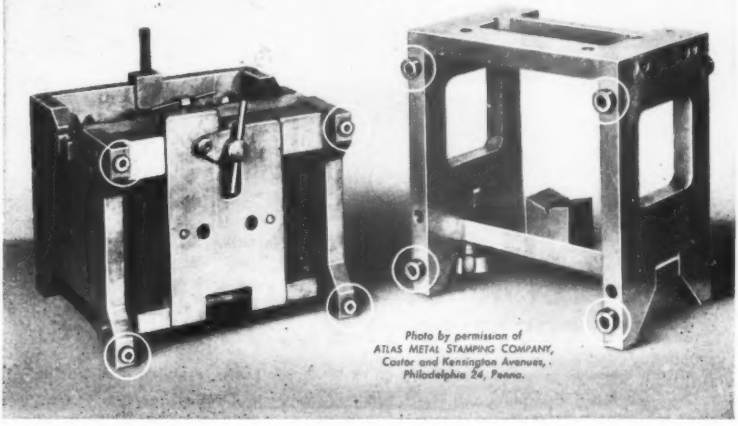


Photo by permission of
ATLAS METAL STAMPING COMPANY,
Castor and Kensington Avenues,
Philadelphia 24, Penna.

Ready-at-hand for the toolmaker's use, — all ready-made except for grinding for squareness, as required in using any other type of feet on jigs or fixtures. Save the time *and* expense of making *special* feet.

Allen Socket Head Cap Screws have the hardness for long wear, but not a degree of hardness subject to cracking. Being replaceable — as special feet often are not — they can be dressed at trifling cost as compared with expense of repairing cracked or broken feet. Handiest, cheapest safeguards against tie-ups in high-production work. . . Available in *standard sizes* for jig and fixture feet, as well as for all general tool and die work. Ask your local Allen Distributor to fill out your stock for this special use.

THE ALLEN MANUFACTURING COMPANY
HARTFORD 1, ★ ALLEN ★ CONNECTICUT, U. S. A.

GAGE BLOCK INSPECTION SERVICE

$15.00

84 BLOCK SET

(Other sets proportionately low)

DON'T LET DOUBT CAUSE CONTROVERSY
. . . IT COSTS SO LITTLE TO BE SURE!

Webber opens its inspection facilities to all users of gage blocks regardless of make. The wear inflicted through daily use over a period of months is sufficiently great to warrant careful examination at periodic intervals. The absence of this precaution can cause controversy and production difficulties. Avoid trouble, send those gage blocks to Webber, now.

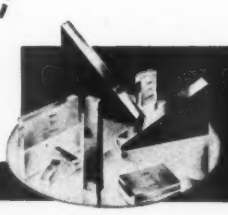
YOUR CERTIFICATE OF ACCURACY

1. *We will return the gage blocks with a Certificate of Inspection showing present size in comparison with master blocks CERTIFIED by the U. S. Bureau of Standards.*
2. *Removal of burrs and nicks which impair accuracy.*
3. *Identification of those blocks beyond repair—along with a recommendation for replacement.*

Webber Gage Co. • 12903 Triskett Rd. • Cleveland 11, Ohio

WEBBER MAKES PRECISION GAGE BLOCKS EXCLUSIVELY

- ★ Gage Block Sets in Steps of .00005"
- ★ Individual Special Size Blocks.
- ★ Heavy Duty Gage Blocks.
- ★ Angle Gage Blocks in Steps of one second.
- ★ Carblox (Carbide) Wear Gages.



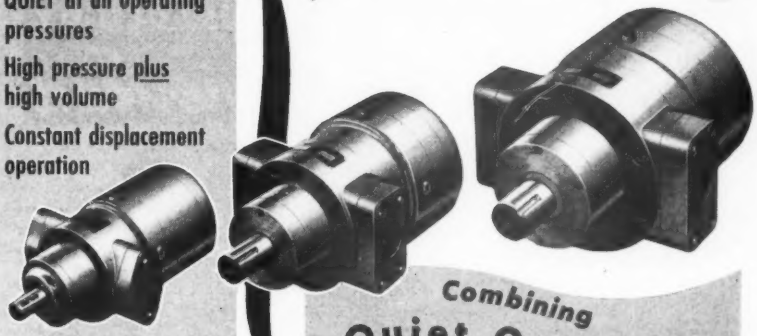
Webber
PRECISION
GAGE BLOCKS

DENISON 3500 SERIES Hydraulic Pumps

QUIET at all operating pressures

High pressure plus high volume

Constant displacement operation



Fewer parts—extremely compact

ALL thrust bearings eliminated

Unique two-piece shaft absorbs deflection . . . reduces bearing wear

Axial piston design lengthens service

Pressure-balanced piston shoe—no direct contact between shoe and cam plate

Combining Quiet Operation High Pressure High Volume

● Now you can have hydraulic pumps that combine *speed* with *power* in a degree never before attained . . . pumps that operate *quietly* throughout their entire speed range . . . pumps so greatly simplified in construction and operation that they bring a new conception of long service-life and low maintenance cost.

Exclusive design of these axial piston, constant-displacement pumps provides high volume delivery at all operating pressures. Actual tests prove that they will operate continuously at 1200 rpm, delivering pressures of 3500 psi with volumetric efficiencies of 95% *or more.*

Among the many outstanding features built into these unique hydraulic pumps is a newly developed pressure-equalization principle, which eliminates the "scream" or noise produced by ordinary hydraulic pumps. They're amazingly quiet at *all* pressures.

Denison HydrOILic Pumps in this 3500 series are available in three models, delivering volumes of 6, 17, and 32 gpm. Write for complete details.

THE DENISON ENGINEERING COMPANY
1197 DUBLIN RD., COLUMBUS 16, OHIO

DENISON EQUIPMENT for APPLIED HydrOILics

Kirsten

BROACHED BY American

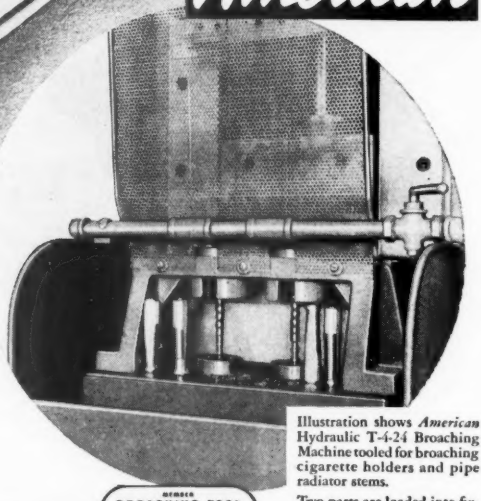


Illustration shows *American* Hydraulic T-4-24 Broaching Machine tooled for broaching cigarette holders and pipe radiator stems.

Two parts are loaded into fixture and the broaches lowered, by means of a special hydraulic retriever unit, thru the parts till the shank ends connect to the pull heads. The main hydraulic machine slide then pulls broaches thru parts —operator removes parts, slide is then reversed to bring broaches up to retriever unit which hydraulically raises to extreme up position ending one complete cycle.

As operator's only function is to insert and remove parts and operate machine levers, production is high—250 pieces per hour. Tolerance is held to .001.

Accuracy and smooth finish are required for the holes in Kirsten pipe radiators and cigarette holder bodies. Close tolerances are needed to fit the arbor for subsequent milling operations on the stem exteriors. Smooth finish is likewise important on inner bores. All these specifications—*plus* an extremely high rate of production—are met in broaching by *American*.

Kirsten master mechanics use the popular *American* T-4 type Broaching Machine, one more example of the many ways in which broaching by *American* can be applied to a wide range of metal working problems.

FOR ALL YOUR BROACHING NEEDS —Machines, Tools, and Engineering—

See American First—

MEMBER BROACHING TOOL INSTITUTE

American BROACH AND MACHINE CO.

ANN ARBOR, MICHIGAN

BROACHING MACHINES
PRESSES
BROACHING TOOLS
SPECIAL MACHINERY

DIVISION OF

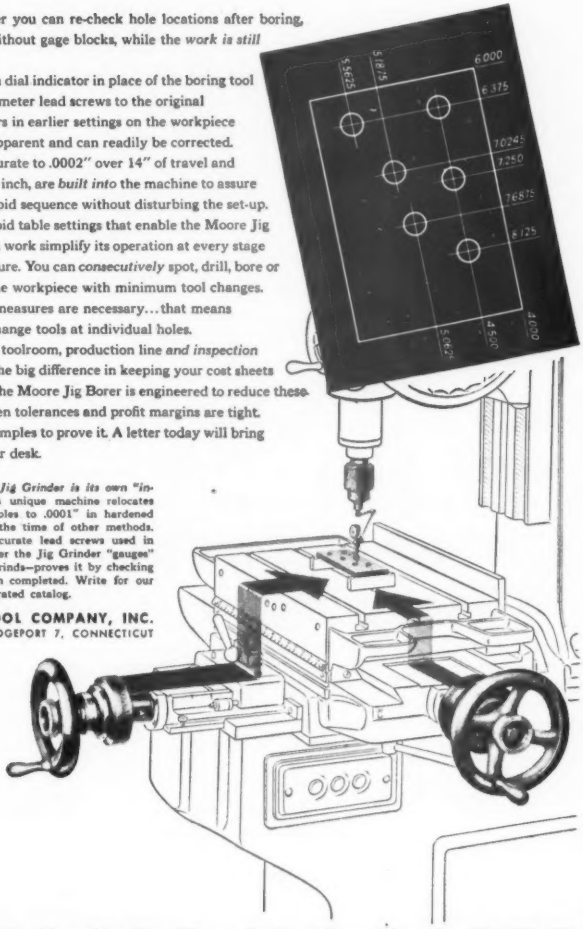
The JIG BORER that inspects its own work

In the Moore Jig Borer you can re-check hole locations after boring, within a "tenth" and without gage blocks, while the *work is still in the machine.*

By simply inserting a dial indicator in place of the boring tool and resetting the micrometer lead screws to the original specifications, any errors in earlier settings on the workpiece become immediately apparent and can readily be corrected. Moore lead screws, accurate to .0002" over 14" of travel and to .00005" in any given inch, are *built into* the machine to assure precise inspection in rapid sequence without disturbing the set-up.

The accurate and rapid table settings that enable the Moore Jig Borer to inspect its own work simplify its operation at every stage of the jig boring procedure. You can *consecutively* spot, drill, bore or ream *all* the holes in the workpiece with minimum tool changes. No size blocks or end measures are necessary... that means less stop-and-start to change tools at individual holes.

Saving hours in your toolroom, production line *and inspection department* can make the big difference in keeping your cost sheets at competitive levels. The Moore Jig Borer is engineered to reduce these all-important hours when tolerances and profit margins are tight. We have many case examples to prove it. A letter today will bring complete details to your desk.



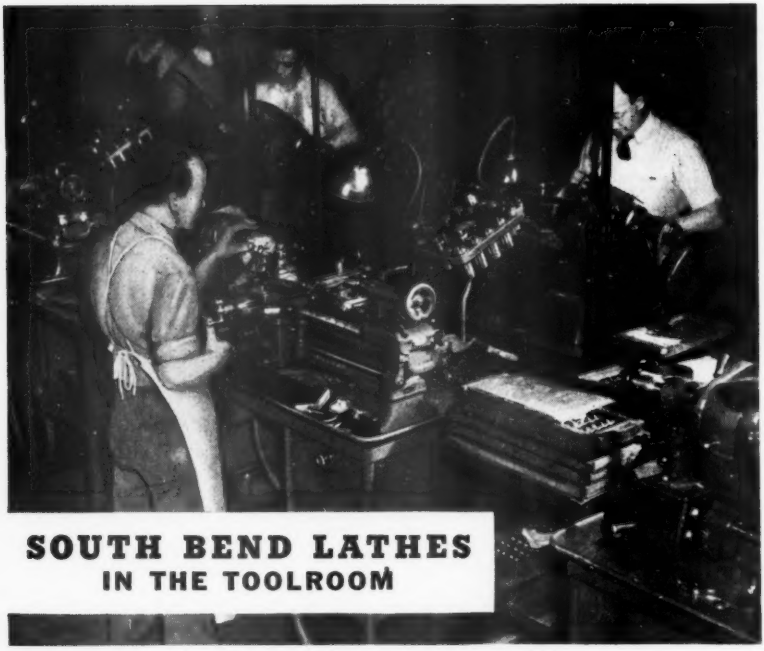
P. S. *The Moore Jig Grinder is its own "inspector", too.* This unique machine relocates and finish-grinds holes to .0001" in hardened parts in one-third the time of other methods. With the same accurate lead screws used in the Moore Jig Borer the Jig Grinder "gauges" its accuracy as it grinds—proves it by checking its own work when completed. Write for our new 28 page illustrated catalog.

MOORE SPECIAL TOOL COMPANY, INC.
726 UNION AVENUE, BRIDGEPORT 7, CONNECTICUT

MOORE JIG TOOLS

MOORE JIG BORER

SPOTS, DRILLS, BORES, REAMS...WITH MINIMUM TOOL CHANGES

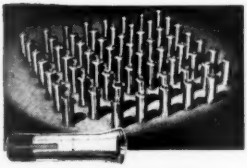


SOUTH BEND LATHES
IN THE TOOLROOM

WHERE PRECISION AND PERFORMANCE COUNT!

Nowhere in the plant are unfailing precision and dependable performance more important than in the toolroom. It is here—in the "tools that make the tools"—that the quality and cost of the product are largely pre-determined.

The ability of South Bend Lathes to perform a wide variety of precision operations makes them the most valuable and versatile tools in the toolroom. The ease and speed with which they can be changed from one set-up to another is a definite advantage and still another reason for their wide popularity. A complete line of attachments and accessories are available which will simplify your tooling still further. Write today for Catalog 100-D which illustrates in full color and completely describes the complete line of South Bend Engine Lathes, Toolroom Lathes, and Turret Lathes. Sent free, postpaid.



SOUTH BEND COLLETS

are available with capacities from 1/16-inch to 1-inch. Made in 1/64-inch steps. Write for Catalog 77 showing line of attachments.

SOUTH BEND LATHE WORKS

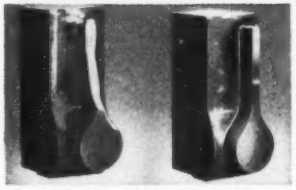
LATHE BUILDERS SINCE 1906

432 EAST MADISON STREET • SOUTH BEND 22, INDIANA

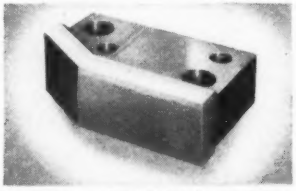
THE PIONEERS

of tool and die WELDING ELECTRODES

. . . can help you save 4 ways



Die unit quickly repaired by welding with Eureka Electrodes. No heat-treat required.



Die unit compositely fabricated with Eureka Electrodes. No heat-treat necessary.

Save many man hours, conserve valuable tools and dies and minimize production delays with the aid of EUREKA TOOL and DIE WELDING ELECTRODES. Here's how it can be done:

1 REPAIRING DIES. . . . Existing units that may fail in operation can be EUREKA welded, either partially or wholly, resulting in a minimum of "down-time."

2 COMPOSITE FABRICATING. . . . Die units can be compositely fabricated, when practical, by EUREKA welding, resulting in numerous advantages.

3 CORRECTING DESIGN. . . . EUREKA welding facilitates making changes in contour, corners or edges during die "try-out" or "change-over" periods.

4 RECTIFYING ERRORS. . . . EUREKA welding permits the correction of errors made in tool and die manufacturing, resulting in great savings.

EUREKA TOOL AND DIE WELDING ELECTRODES

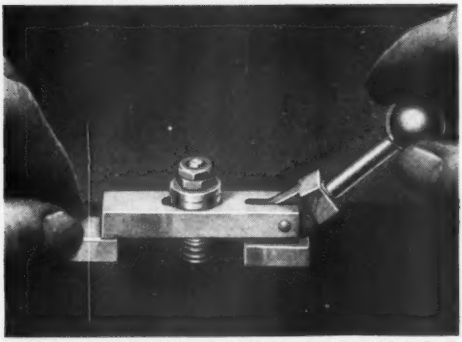
Welding Equipment & Supply Co.

PIONEERS IN TOOL AND DIE WELDING ELECTRODES

225 Leib Street • Detroit 7, Michigan

for BETTER-QUICKER HOLDING OF SMALL WORK PIECES . . . .

WESPO



WESPO FIXTURE FITTINGS SAVE TIME AND MONEY

We make a complete line of WESPO fixture fittings. Keep a supply on hand—they cut designer's time and save ½ of your making cost. Precision made of heat treated alloy steels—cadmium plated. Full scale template drawings and prices on request.

Spherical Washers with Ground Radii

MIGHTY MIDGET QUICK ACTION FIXTURE CLAMP

WESPO Midget clamps also made in 3 other types. Larger clamps in 5 types—6 sizes each. All clamps are precision made from heat treated alloy steel, cadimium plated. Full scale template drawings of each model and size, as well as bulletin and prices, sent on request.

Above, "C" Washer

Below, Quarter Turn Screw

WEST POINT MANUFACTURING CO.

19644 MERRIMAN COURT

FARMINGTON, MICH.

NEW

Single-Unit Motor-Driven

20" ROTARY TABLE

- Eliminctes all set-up time.
- May be used on any make of milling machine or horizontal boring mill.
- Plug it into the nearest light socket and it's ready to go.

Write for Complete Information

W. B. KNIGHT

MACHINERY COMPANY

KNIGHT VERSATILE ACCURATE RIGID MILLERS

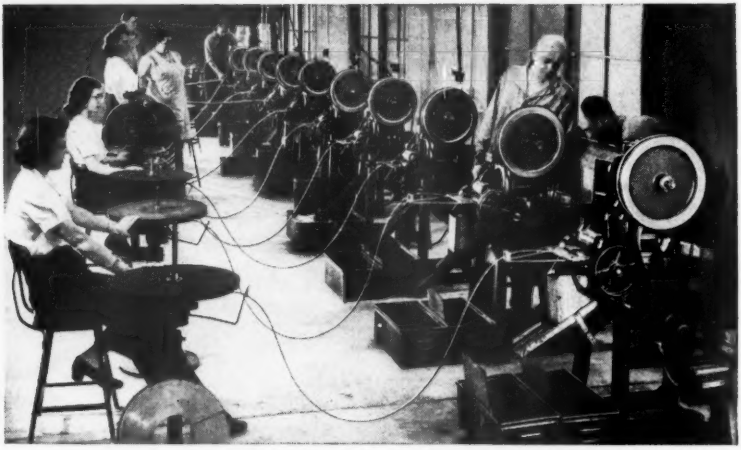
MORE GOODS for MORE PEOPLE at LOWER COST

3920 WEST PINE BLVD. • ST. LOUIS 8, MISSOURI

PRODUCTION PLUS!

OVER a million stampings per day with this battery of

DIEBEL Hi-Speed 550 R.P.M. AUTOMATIC PRESSES



THESE 10 PRESSES OCCUPY ONLY 12 FT. x 45 FT.

The speed of this automatic press—it's adjustable up to 550 strokes per minute!—has resulted in soaring production records over a period of years in hundreds of plants. Diebel Hi-Speed Automatic Presses, like those above, have performed wonders on steel, brass, phosphor-bronze, fiber, plastics, rubber and paper.

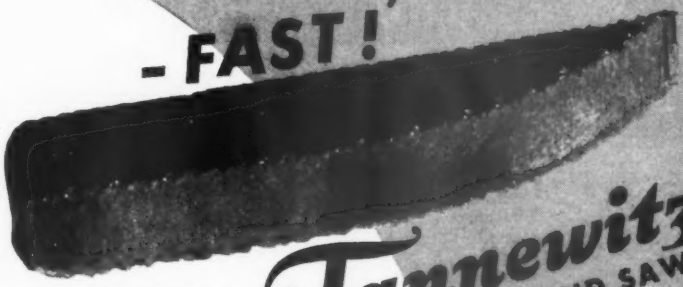
May we send you our illustrated circular? It's yours for the asking—an introduction to the solution of your light blanking and forming problems.

DIEBEL MACHINE CORP.
DIVISION OF DIEBEL DIE & MFG. CO.
2708 West Irving Park Road Chicago 18, Illinois

for Sawing **METAL** *as* **HARD** *as a* **FILE**

or Trimming **FORMED PARTS**

- FAST!



Actual photo of file friction sawn on Tannewitz High Speed Band Saw.

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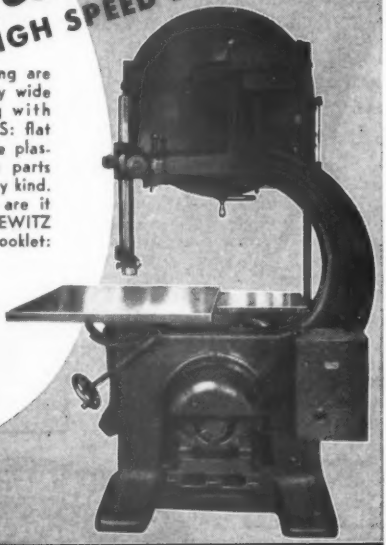

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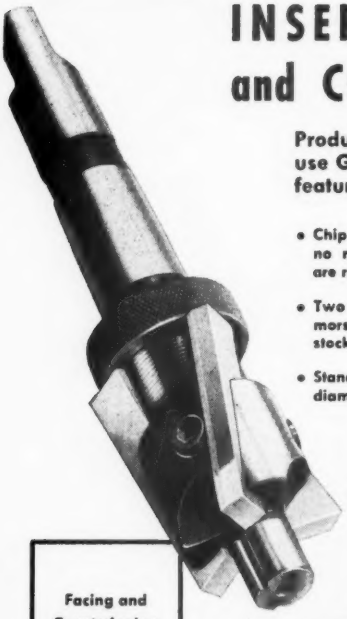

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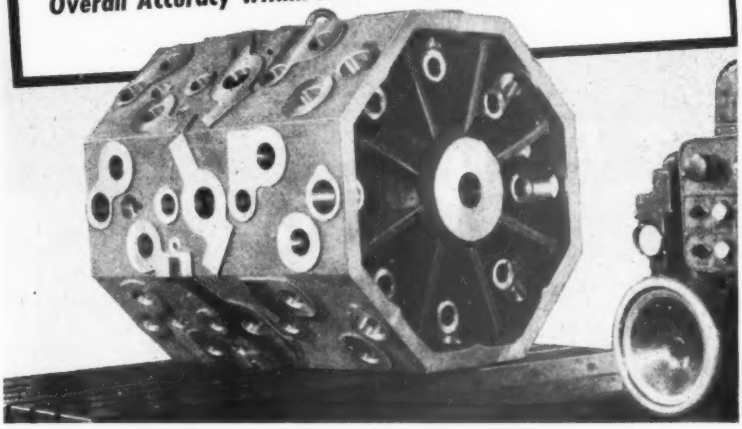

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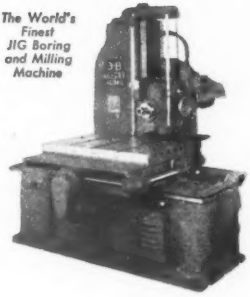

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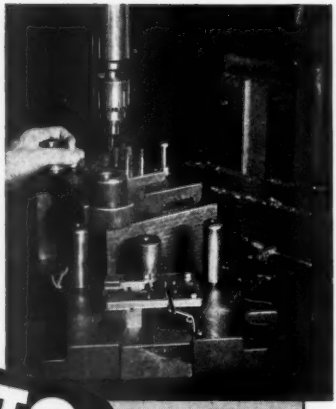

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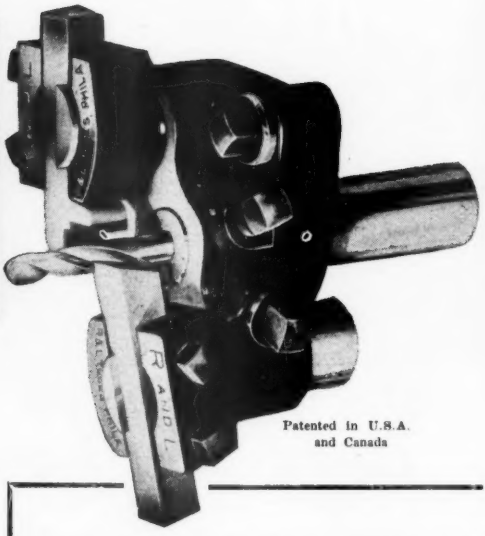
Will Do The Work Of All These For Either Right or Left Hand Operations



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All these and many other features are shown by photographs in drawings in descriptive booklet mailed without cost or obligation. The booklet illustrates the tool set-up for various operations, and indicates speed and simplicity of its adaptation to various jobs. Prices and full specifications of many available sizes are included. Write for your copy today.

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SAVE TIME — by avoiding use of slower machines designed to produce large work.

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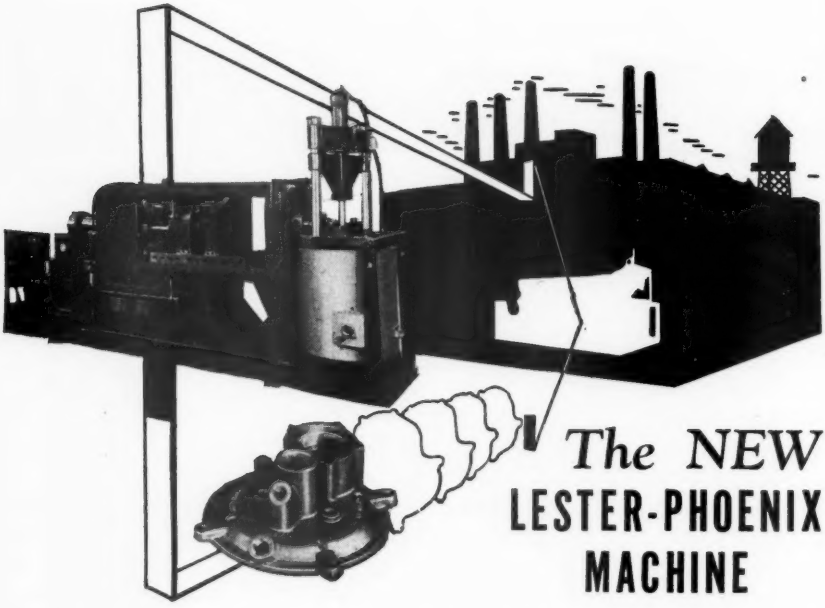
PERFORMANCE HAS ESTABLISHED LEADERSHIP FOR HARDINGE



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DIE CASTING MACHINES

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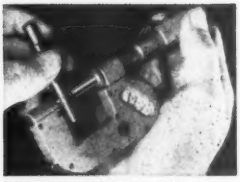
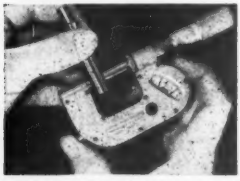


USED AS A MICROMETER — spindle is brought into contact until Indicator reads "O".



USED AS A GAGE — push button retracts anvil and dimension is checked on dial.

. . . Has Many Advantages Over Usual Type Micrometers

This new Federal Indicating Micrometer combines the precision of the Dial Indicator for uniformity of contact pressure and for use as a comparator, with the accuracy of the micrometer thread for measuring.

You do not need the skill of a toolmaker to operate it accurately. The Dial Indicator insures uniform contact pressure.

It takes the place of a complete set of "go and no-go" gages, because you can set it to the required size, clamp it in that position, and gage your batch of workpieces.

Anvil is retractable. Both contacts are Tungsten Carbide tipped.

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PRECISION MEASURING INSTRUMENTS

tooling and advertising

Two of the most indispensable ingredients in the recipe for successful conversion of ideas and materials into products and dollars are tooling and advertising. TOOL & DIE JOURNAL's editorial premise: *the design, manufacture and use of production tooling,* would become a hollow meaningless phrase if advertising was not performing its concurrent functions of introducing and describing new and improved products and services, creating new wants, and cultivating more customers and sales where one grew before.

Conversely, all the advertising psychology, art and phraseology that could be brought to bear would not succeed in selling products that were not efficiently and ingeniously produced to meet competition by the latest techniques and innovations in production tooling.

The final yardstick that measures the effectiveness of both tooling and advertising is the buyer's or consumer's dollar; the ease with which it is put in circulation.

There is increasing evidence, for those who want to see, that the postwar buying dollar is not quite the rolling stone as was its wartime buddy. The wartime dollar led a dizzy pace and lightly skipped through many hands in looking for a place to light. The postwar dollar is settling down to a more dignified life, spends more time at home and is more willing to be waited upon.

We can cite two current examples of the mutual dependency of tooling and advertising in the joint effort of prodding the postwar dollar into keeping on the move.

One: an electrical appliance manufacturer, in reapportioning advertising funds and space, curtailed, for seemingly good and sufficient reasons at the time, allocations on one item in the line. In short order, that one device, in spite of the ingenious special machines, tools, jigs and fixtures employed in its production, ceased to interest Mrs. Housewife, and the flow of production backed up; from dealers' shelves to wholesaler, to distributor, right back to manufacturer's finished goods inventory. The advertising craftsmen are now vigorously retooling the advertising to break that bottleneck.

Two: we weren't fully aware, until year-end business summaries appeared, of the unprecedented extent to which a great variety of consumer goods had been marked down in price *before* Christmas; moves that were necessary to meet the newly acquired habits of the postwar dollar. In the face of this definite trend toward a buyers' market, new tooling will have to come to the rescue of advertising to insure the continuing exchange of these goods for the buyer's dollar.

New tooling and retooling to effect production economies in both time and material is the personal challenge confronting TOOL & DIE JOURNAL readers, the designers and builders of industry's special machines and production tooling. As they exercise their skills, advertising can most effectively speak its piece.

E. Willard Cunningham

editor

VIBRATION VS PRECISION

In Single Point Boring Tools

Precision boring with the single point boring spindle machine such as Heald, Ex-Cell-O and Stokerunit equipment has always presented a particular problem when the tool engineer or process engineer is confronted with a long bore such as might be encountered in a piston pin hole, sleeve or transmission housing.

The problem always becomes dependent upon the relationship or ratio which exists between bore diameter and length of bore. This is due to spindle "whip", or boring bar "periods of vibration" which distort the hole as to size and are detrimental to fine finish. It is particularly true of the offset finishing bars where the axis of rotation generates a circular locus of oscillation about the normal central axis. The extent of the oscillation, of course, amplifies the whip or increases the periods of vibration. In other words, the greater the offset, the more spindle whip.

by A. W. Ehlers
Contributing Editor

Diamond boring spindles, erroneously so called in so far as carbides have replaced the original diamond pointed tools, are operated at high spindle speeds using the finest of spindle bearings and spindle design supports. However, each such spindle head, no matter how carefully designed, has an inherent period of vibration which becomes evident under certain conditions of speed, feed and material being cut. This inherent vibration characteristic may be quiescent and of no consequence on most jobs at normal feeds and speeds. However, minute changes in any of the factors involved sometimes produce weird results which defy correction until the length of the boring bar is shortened or production feeds sacrificed.

The conservative relationship existing between bore diameter and length of bore as adopted by most tool engineers dealing with single point boring problems never went beyond a 4 to 1 ratio. In other words, the length of the boring spindle was limited to being only four times the diameter of the bore itself. This meant, consequently, that it was skirting the borderline of good continuous production practice when a one-inch hole was being bored to a depth of four inches and to tolerances of plus or minus .0002". This was especially true when surface finish was a consideration. Using the offset finishing bar as the pilot section extending beyond the tool point added to the effective bar length to such an extent that the 4 to 1 ratio was disturbed in many cases. The only "out" when confronted with this situation was to sacrifice the depth of cut and the regular production feeds in an empirical manner to finally find a combination that produced a passable hole.

The writer, in discussing this limiting relationship between spindle length and bore diameter with several field engineers of the various equipment manufacturers, asked whether experimentation had been conducted with various

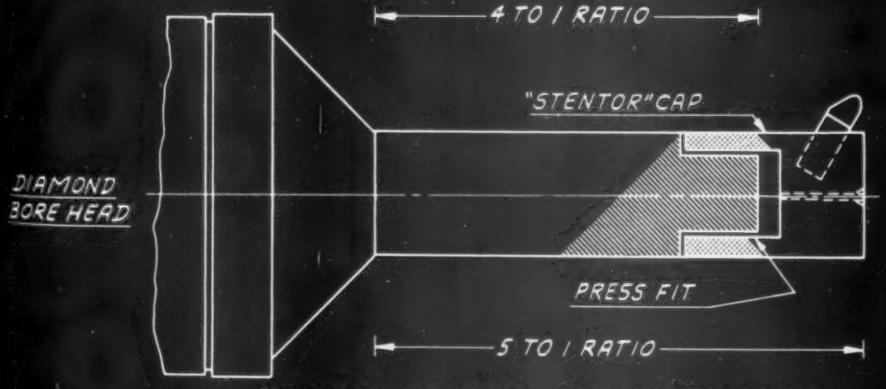
steels and hardness variables in an effort to change the inherent bar and spindle whip. The usual reply was that all manner of empirical approaches had been made in steel composition and heat treatment in an attempt to whip the "whip". As an example, Heald uses a hollow steel forging for their larger diameter spindles with some measure of success on finish boring operations on cylinder sleeves.

Through necessity, the writer was forced to extend boring bars beyond the safe 4 to 1 ratio. The solid bars usually developed whip to such an extent that feeds had to be slowed down and spindle speeds adjusted to a production rate well below normal expectation and the surface finish in the bored hole suffered, especially on cast iron. True, some relief on the surface finish problem was effected by changing the tool contour as to radius and approach angles. However, tool life suffered again and the production per hour fell accordingly.

To break up the period of vibration or to dampen the whip generated in the extended boring bar was the evident problem and the writer attempted several empirical "shots in the dark" to alleviate same. One of these worked rather successfully and was easy to effect as depicted in the accompanying drawing. The original bar was ground back to the safe 4 to 1 ratio as to length. Then the bar was held between centers on a cylindrical grinder and an undercut on the end of the bar was ground away as indicated in the sketch. A cap was made of a tough-grained steel, such as Carpenter "Stentor", and pressed on to the ground relief section of the spindle, and then cylindrically ground again to true up any press-fit misalignment. The holding of the single point boring tool becomes thereby a function of the "Stentor" cap rather than of the metal making up the original bar. The junction of the two differently grained steels and the breaking up of the surface continuity effected by the pressed fit of the cap successfully dampened the vibration wave to such an extent that a passable hole was bored at regular production feeds and speeds. It was found that this "cap dampening" could be used to extend the 4 to 1 ratio in cast iron to 5 to 1, and in aluminum to 5½ to 1.

Always rather over-enthused after a successful shot in the dark, the writer envisioned a laminated set of dissimilar materials such as steel and carbide, silver soldered together to form a boring bar that would break up methodically and periodically any vibration wave that might be generated. Luckily for our

The development and application of this press-fitted boring bar extension cap of dissimilar metal resulted in sufficient vibration dampening to permit an increase of boring bar length/diameter ratio to 5:1 for working cast iron and 5½:1 for aluminum.



EXTENSION OF DIAMOND BORE SPINDLE BY CAPPING.

ever-suffering toolmakers and for the general well being of the boring machine operators, no such boring bar ever grew beyond the imaginative stage as the writer felt a little dubious about the tensile strength of the silver solder operating at the high spindle speeds. Nevertheless, the writer would like to see one of the carbide tool specialists attempt it (at their own risk of course and behind a bullet proof shield) for it might prove very interesting from both a boring bar and a projectile standpoint.

However, at the tool show held in Cleveland last year, the writer noticed some solid carbide boring bars being exhibited by the Carboloy Company. These bars were for use on the standard horizontal single point boring machines. Information was rather sketchy at the time, but as relative whip or vibration is a factor related to the critical speed of rotation of the shaft or to the modulus of elasticity of the shaft material itself, the writer reasoned that the junction of two dissimilar materials such as the steel spindle face and the carbide boring bar should substantiate his original "cap" experiments. Also, as tungsten carbide has a modulus of elasticity of approximately 79,000,000 pounds greater than steel which is 28.6 per Young's Modulus (1,000,000 pounds per square inch) the effect of spindle whip should be further controlled using the entire bar as a solid piece of carbide.

Several solid carbide bars were ordered to lengths beyond the 4 to 1 ratios. However, it was found rather difficult to grind the OD of the carbide for a press fit and to bore the old spindle faces accordingly with the average tool room equipment. Therefore, the writer suggests that the entire assembly of spindle face and bar be ordered as a unit from either the equipment or the carbide manufacturer.

All of the solid carbide bars now in use by the writer have proved their worth as to lack of whip when the ratio is extended beyond the 4 to 1 limits. Also, the bars permit a definite increase in both roughing and finishing feeds with correspondingly good bored hole surface finishes and tolerances. A double tooled bar is now in experimental production to prove if a piston pin hole can be rough and finished bored from one head and spindle. This bar exceeds the 6 to 1 ratio and the diameter of the hole is less than .500". This experiment, however, approaches some limiting factor, for, as the diameter of the bar is decreased and the length is increased, the extreme brittleness of the carbides may demonstrate that the extended ratio of approximately 6 to 1, so far empirically established, may not hold as the diameters of the boring bars become less than .500".

One field engineer for one of the boring machine manufacturers relates that as the boring bars decrease in size from one half inch diameter, carbides are not too successful when judged against the solid steel bars. However, the writer is using a 5 to 1 ratio bar on a .249" hole very successfully and with greater feeds than were possible with the conventional steel bars. Also, very consistent production tolerances of .0002" are being held on piece work operation where much trouble was experienced when using the steel bars.

The carbide boring bar assemblies as furnished by either the equipment manufacturer or the Carboloy Company were found to be very meticulously made. However, some reworking is usually necessary as to chip clearance behind the cutting point of the tool itself. This is easily effected in the tool room and is of necessity a cut and try job dependent upon the material, machine and the feeds being used.

If the reader wishes exact information concerning a particular boring problem, the writer suggests that he contact the field engineers of the equipment or the carbide manufacturers for details as to cost and other limitations.

The writer wishes to conclude with the statement that the application of solid carbide boring bars for use on the single point precision boring machines is worthy of immediate investigation by all those concerned with precision boring problems; but if the reader is in trouble with a present application on an extended boring bar, a trial of the capping idea as explained in the previous paragraphs may lick the situation.

The Manufacture Of Precision Castings*

Part I

The manufacture of intricate parts by precision casting methods, when such methods are applicable, offers a number of advantages which frequently are not utilized to the fullest extent. The fact that few, if any, limitations exist in the shape or material that can be cast and that a casting can, furthermore, be made to closer limits than is generally possible by other non-machining methods is of considerable importance both to the engineer and the production man. It is felt that a better understanding of the uses and applications for these methods and an analysis of their advantages and limitations will not only be helpful in connection with present production problems, but will allow us to guide some of our thinking relative to future designs. With this in mind, the following discussion of the various methods is offered, with particular emphasis on the investment molding methods which have not been as commonly applied in the automotive field as some of the others.

by G. Vennerholm and E. Ensign

Ford Motor Company

Defining Precision Casting

Although the term precision casting during the war became more or less synonymous with the so-called lost wax process, it is our belief that this term embraces not only the lost wax process but any and all of the casting methods which will allow a reproduction of parts within such dimensional and surface finish tolerances as to eliminate some or all of the machining operations normally required.

Assuming that we are correct in this definition, we may then conclude that the following processes are applicable in the manufacture of precision castings: (1) Die Casting, (2) Permanent Mold Casting, (3) Investment Molding, or possibly more properly called Slip Molding, (4) Plaster Molding, and (5) combinations of two or more of the preceding.

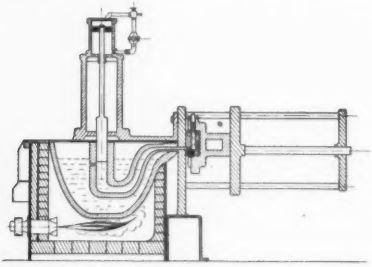
Before proceeding with our discussion of these various processes and their applications and limitations, it may be in order to point out some of the major advantages that can be derived from precision castings.

Costs, Design Freedom and Materials

Common to all methods of precision casting when compared with conventional casting methods is the higher yield due to fewer and smaller gates and risers being required. Together with the higher yield is perhaps the most attrac-

This paper, a highly informative disclosure of precision casting know-how, was presented at the Society of Automotive Engineers' Annual Meeting, Detroit, January 1947. In featuring it for TOOL & DIE JOURNAL readers we gratefully acknowledge the courtesy and cooperation of the authors and the Society. Ed.

Fig. 1. Schematic cross-section of plunger type die casting machine. By either pneumatic, hydraulic or mechanical means, the piston or ram forces the molten metal into the die cavity under pressure of from 1500 to 3000 psi.



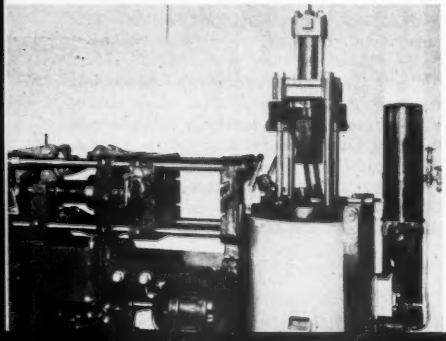
tive advantage, that of eliminating machining. The amount of machining which may be eliminated depends upon the extent one is willing to refine the tools for the particular casting in question. Precision casting, furthermore, eliminates the necessity to procure costly raw material in the form of bars, strips, sheets, etc., which can be replaced by inexpensive pigs, or in many cases, scrap suitable for melting. These facts make precision casting the shortest distance from raw material to finished product.

Although in some precision casting methods, such as die casting and to a lesser extent permanent mold casting, the initial equipment cost is high, this cost is inversely proportional to the number of parts cast, because of the fact that the life of the tools is very great and the same may, therefore, be amortized over a large number of parts.

Of particular interest to the designer is the high degree of freedom which may be exercised in design and in choice of materials enabling him to select practically any shape without regard to draft and very little regard to size, when one considers all methods which we designate as precision casting.

Formerly in precision castings, one thought of using only a limited number of materials such as lead, zinc, brass, aluminum, and in the case of very small objects, the precious metals. Shapes cast were in general relatively simple and the weights were in terms of ounces. Now we are able to consider the higher melting metals and alloys as well, making our selection on the basis of the function of the part rather than suitability to a particular casting method. The weights of the parts cast have also increased many fold.

Fig. 2. A typical plunger type die casting machine. As designed for tin and lead base babbitts and zinc base alloys, it has a production rate up to 400 shots per hour. Through various models shot capacities (zinc) of 4 to 19 pounds, and metal pot capacities (zinc) of 350 to 1000 pounds, are available. Photo courtesy Lester-Phoenix, Inc.



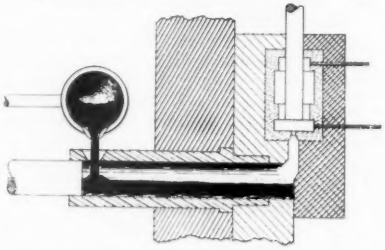


Fig. 3. The cold chamber machine, used for aluminum, magnesium and copper base alloys, consists of a pressure chamber fitted with a power ram.

Die Casting

Die casting is perhaps the oldest form of precision casting to find any application in the automotive field. The process in which the molten metal is injected by pressure into a metallic die set mounted in a machine owes its origin to the early type-casting methods adopted in the linotype machines. This method

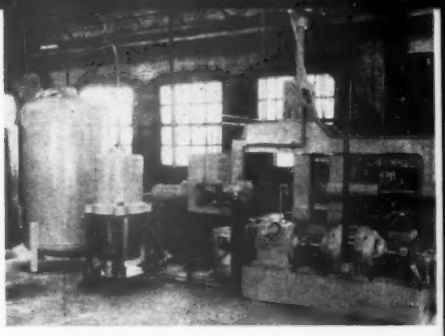


Fig. 4. A cold chamber machine installation. Cold chamber equipment utilizes pressures as high as 100,000 psi.

was originally used only for low melting alloys such as tin and lead base babbitts and later zinc base alloys. Continued developments in both machines and casting alloys, however, made the successful manufacture of aluminum castings possible in about 1916, and at a later date, magnesium base and copper base alloys as well.

Three different types of die casting machines known as the (a) goose neck, (b) plunger, and (c) cold chamber machine have been developed which although in principle the same, differ in the method used to inject the metal into the die. Common to all three is a fast working machine in which water cooled dies are mounted in such a manner that one die section is stationary and the other is attached to a moving carriage. A suitable device is incorporated to strip the finished casting from the die.

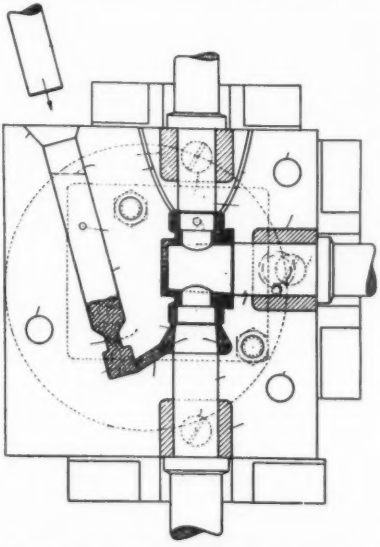


Fig. 5. A schematic of another arrangement of pressure chamber and power ram as used in cold chamber work.

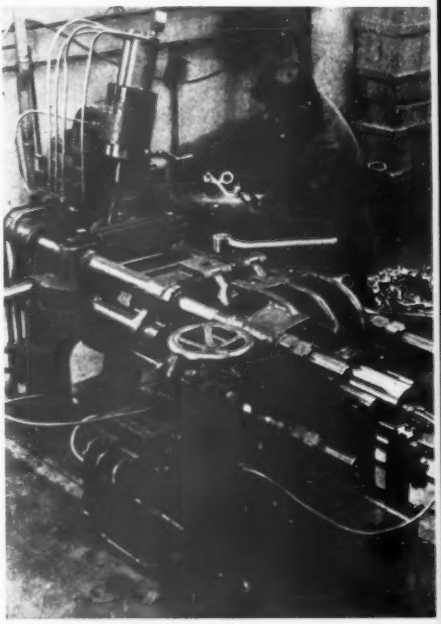


Fig. 6. The high pressure involved in cold chamber work results in castings of greater density and dimensional stability than obtainable at lower pressures.

(a) The Goose Neck Machine

The goose neck or air injection machine is fitted with a goose neck submerged in the metal pot through which the molten metal is forced into the die by applying air pressure. These machines, used mainly for aluminum castings, are limited in the pressure applied

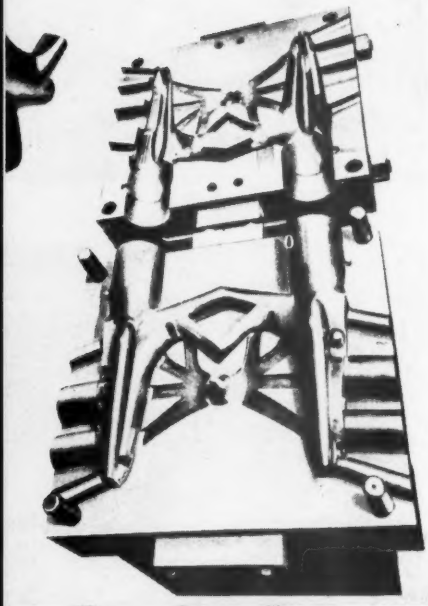


Fig. 7. The production rate of cold chamber machines in many instances exceeds that of the goose neck or plunger machines. This is because of the greater use of multiple cavity dies, such as the above, which produces simultaneously the two parts making up an aluminum housing.

upon the metal in the die cavity to about 600 psi, which pressure is not sufficient to exert a squeeze action on the metal while it is in the plastic state. The production rate of this machine is governed by the size of the casting but does generally not exceed 110 shots per hour.

(b) The Plunger Machine

The plunger machine utilizes a cylinder or pressure chamber fitted with a piston or ram inserted in the molten metal as indicated in Figure 1. The metal is forced into the die by exerting pressure of from 1500 to 3000 psi on the piston by either pneumatic, hydraulic or mechanical means. This type of machine is generally used for casting tin and lead base babbitts as well as zinc base alloys and has a production rate of from 100 to 400 shots per hour. Figure 2 shows a typical plunger type die casting machine.

(c) The Cold Chamber Machine

The most modern and by far the most effective machine used for aluminum, magnesium and copper base alloys is the cold chamber machine which consists of a pressure chamber fitted with a power ram as shown in Figure 3. The required amount of metal is ladled from the melting pot into the chamber and forced into the die by applying hydraulic power to the ram. Different types of such machines are shown in Figures 4, 5, and 6.

The advantage of this method over those previously described is that the pressure which can be applied is limited only by the locking capacity of the machine. The fact that pressures as high as 100,000 psi may be utilized makes it possible to exert a squeeze action during solidification and while the metal is in the plastic state, thereby simulating the extrusion press principle. The result is a casting of greater density and dimensional stability than is obtainable with the other machines.

The production rate of this machine, although limited to about one hundred and fifty (150) shots per hour, in many instances exceeds that of the goose neck or plunger machines because of the greater extent to which multiple cavity dies can be used. A further advantage is the increased yield obtained as well as the greater safety connected with this machine.

Typical die castings made by the plunger and cold chamber machines are shown in Figures 7, 8, 9 and 10.

Permanent Mold Process

The permanent mold process, although basically the same as the die casting process, differs from the latter in that the metal is introduced into the die by gravity. The name permanent mold is somewhat of a misnomer in that it indicates unlimited mold life which is by no means the case, and perhaps the

English term "gravity die casting" would be more appropriate.

Because of the absence of any external pressure, it becomes necessary with this method to gate and riser the castings in a manner similar to that used for sand castings.

The simplest form of the permanent mold process consists of two die halves which are clamped together and into which the metal is ladled by hand. When greater accuracy is required and larger or more complex castings are to be made, the dies are usually mounted in a mechanically or hydraulically operated machine, one half being stationary and the other half sliding, or when the design permits, the two die halves are frequently hinged together thereby simplifying the mechanism.

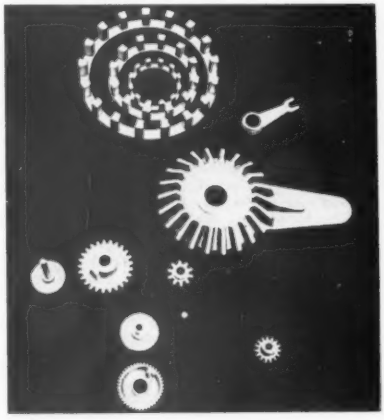
A typical non-ferrous permanent mold casting machine and castings are shown in Figures 11 and 12.

The production rate of permanent mold machines is generally much lower than obtained with die casting, usually about 25 to a maximum of 75 fills per hour. This apparent drawback, however, is frequently outweighed by certain advantages inherent in this process which will be described later.

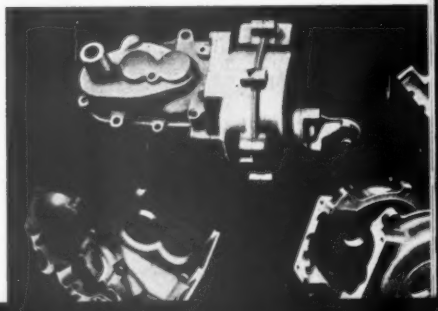
The die material used generally consists of a heat resistant alloy cast iron which permits casting the dies to nearly finished shape thereby effecting a considerable saving in cost as compared with machined and heat treated steel dies.

By far the largest tonnage made by the permanent mold process is of aluminum castings, with copper base alloys as a close second. Some zinc alloy castings are also made but these are inferior to die castings and are frequently replaced by aluminum castings when the permanent mold process is used.

In addition to the above metals, considerable quantities of ferrous castings, in particular gray iron, are manufactured by the permanent mold process,



Figs. 8, 9 and 10. Representative aluminum and bronze die cast components for the automotive industry. The bearing cages and gears are of bronze, and the various cylinder, crankcase and carburetor parts are of aluminum alloys.



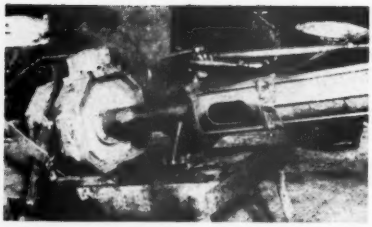
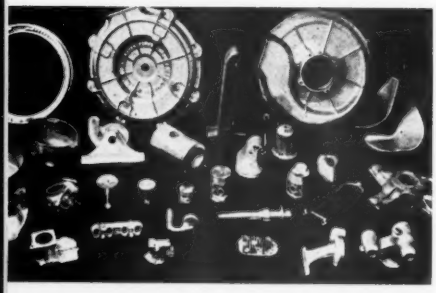


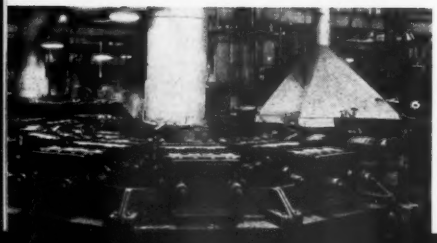
Fig. 11. A permanent mold machine for producing non-ferrous castings. The simplest form of the process consists of two die halves which are clamped together and into which the metal is ladled by hand.

which process therefore has a considerably greater field of application than die casting processes.

A permanent mold machine for ferrous castings and gray iron and typical examples of parts made are illustrated in Figures 13 and 14.

Fig. 12. A representative variety of non-ferrous, permanent mold castings indicating the design freedom characteristic of the process. In this process the melt is introduced into the die by gravity rather than external pressure, hence it is necessary to gate and riser the work as in sand castings. Photo courtesy Bohn Aluminum & Brass Corp.





Semi-Permanent Mold Process

In general the castings made by the permanent mold process are of such shape that they do not require large numbers of slides and inserts. A modification of the method, however, called the semi-permanent mold process, permits very complex internal shapes to be cast by utilizing inserted refractory cores of sand or plaster, the latter to be discussed later in greater detail.

Die Casting vs Permanent Mold Casting

The various forms of die casting methods described, despite their limitations, offer the engineer and production man the solution to many design as well as production problems. It is, however, necessary to carefully consider the following factors in order to determine the applicability of these processes to the manufacture of a given part: (a) type of metal to be cast, (b) required tolerances and surface finish, (c) size, shape and minimum wall thicknesses of castings, (d) soundness and physical properties, (e) total number of castings to be made and rate of production.

(a) Type Of Metal To Be Cast

Both methods permit the casting of aluminum, magnesium and copper base alloys as well as tin and lead base babbitts. Zinc base alloys, however, are usually die cast and generally replaced by aluminum when made by the permanent mold process. Ferrous castings, particularly gray iron but also to a limited extent steel, are made by the permanent mold process.

(b) Required Tolerances And Surface Finish

For maximum accuracy and best surface finish the die casting process excels the permanent mold process. The accompanying table, Figure 15, taken from "Handbook on Design for Quantity Production" by H. Chase, indicates the tolerances obtainable with the two methods.

Fig. 13. A high production permanent mold machine for ferrous castings, arranged for a progressive rotary cycle of close, pour, cool and unload.

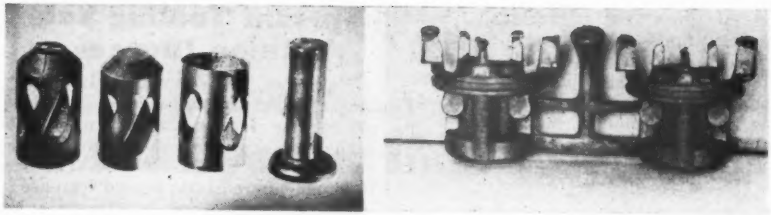


Fig. 14. Representative gray iron permanent mold castings. Note the similarity of gates and risers to sand casting methods.

(c) Size, Shape And Minimum Wall Thickness of Castings

The permanent mold process at the present permits much larger castings to be made than is possible with the die casting process, with fifty (50) pounds in aluminum not unusual for the former and twenty (20) to twenty-five (25) pounds being the maximum for the latter.

When complicated designs or thin walls are encountered, pressure die casting is usually resorted to as this assures the filling out of sections which would not flow in a permanent mold.

Frequently, however, the shape and configuration of the internal cavities exclude die casting in which case the semi-permanent mold process can frequently be adopted provided the casting is of such nature as to permit feeding by gravity or when external forces such as produced by centrifugal methods can be applied.

(d) Soundness And Physical Properties

The high injection pressure used in the die casting process usually traps some air in the casting, resulting in porosity. Although the permanent mold casting is not always free from porosity, the tendency toward this is lessened to the extent where it is sometimes found that heat treatable aluminum alloys cast in permanent molds produce higher properties after heat treatment. The ill effects resulting from porosity can, however, be greatly minimized in die casting by utilizing high pressures.

Of considerable interest and importance when casting gray iron by the permanent mold process is the high internal pressure resulting from graphite precipitation which aids materially in producing sound and dense castings.

(e) Total Number Of Castings To Be Made And Rate Of Production

The total number of castings to be made and the rate of production will greatly affect the selection of the method provided that both are applicable. Die casting with a rather high initial installation cost by comparison and high die cost, but with a production rate

Fig. 15. Tolerances And Wall Thicknesses For Non-Ferrous Castings.

METHOD	Tolerances				Wall Thicknesses (Min. for small areas)			
	Zn	Al	Cu alloys	Mg	Zn	Al	Cu Alloys	Mg
Die Casting	.001" per inch but at least .0025"	.0015" per inch but at least .003"	.003" per inch but at least .005"	.0015" per inch but at least .003"	.020"	.035"	.050"	.050"
Permanent Mold Casting	....	.0015" per inch but at least .010"	.005" per inch but at least .010"	.0015" per inch but at least .010"	....	.125"	.075"	.187"

Source: "Handbook on Design for Quantity Production" by. H. Chase.

several times that of permanent mold casting, finds its greatest usefulness when large quantities are required. Short runs, on the other hand, can frequently be made more economically by the slower permanent mold process because of much lower installation and die cost.

(TO BE CONTINUED)

References:

"Permanent Mold Castings," by A. Sugar, Materials and Methods, Manual 5.

"Handbook on Designing for Quantity Production," Herbert Chase.

"Process Control of Aluminum Foundry Procedure," Society of Automotive Engineers, Inc.

"High-Pressure Die Casting," H. L. Harvill.

"Casting H.S.S. Tools and Cutters," Ford Motor Company.

"Die Casting," Herbert Chase, Materials and Methods, Manual 10.

Editor's Blueprint For March

A Fast-working Taper Gage
—the construction of a special gage by which the grinder operator, with only occasional reference to a master gage, can insure high precision uniformity of output.

Roughing, Finishing and Counterboring In One Setup
—contributing editor Ehlers details a tooling project involving horizontally opposed, single spindle boring machines and the attaining of counterbore concentricity of .0002".

Temporary and Semi-permanent Dies
—a leading authority in the techniques of short-order production raises the iron curtain that has obscured some of the know-how pertinent to this highly specialized segment of the tool and die industry.

Continuing Features:

A Tooling Program for Forged Globe Valves
—assistant editor Benner's fifth installment deals with straight and form turning, drilling, counterboring, internal and external threading and broaching.

Hydraulics
—Mr. Ransom Tyler of The Oilgear Company contributes "Hydraulic Circuits & Applications."

Special Tooling Sales Volume Increases

November and December 1946 shipments of special and semi-standard units of tooling for production were 24% higher in dollar sales volume than in the corresponding months of 1945. This rise in shipments indicates a good increase in actual volume, since country-wide reports show that the general price levels on tool and die work fall short of reflecting increases in costs, and have changed but little since V-J Day.

"This means that manufacturers of metal articles are planning on tooling more intensively to reduce their costs," said George S. Eaton, Executive Secretary of the National Tool and Die Manufacturers Association. "It also means that the approach of keener competition is causing some to prepare to bring out really new postwar models, in spite of all the labor and material uncertainties that have plagued the country."

With the increasing realization of the cost-reducing value of specialized tooling, Mr. Eaton looks for a continuing rise in the use of custom-built production dies, jigs, fixtures and machines and a national increase in tool and die shop operations.

The directors of the National Tool and Die Manufacturers Association held their quarterly meeting in Cleveland on January 24 and 25. A special committee appointed to handle labor legislative matters consists of: W. R. White, Jr., Chicago (Chairman); B. C. Buerk, Buffalo; R. E. Ehrhardt, Dayton; C. W. Holmberg, New York; L. R. Lance, Jr., Philadelphia; R. F. Moore, Bridgeport; R. F. Mueller, St. Louis.

In commenting on the "Principles of Business Conduct", recently approved, president Willis G. Ehrhardt said:

"The tool and die manufacturer's ingenuity and experience often cut costs sharply through special tooling. Such service is essentially professional in nature, and the business dealings between the tool and die shop owner and his customers should be on the highest plane. It is the purpose of this code to encourage fair play in these relationships."

Principles Of Production Economy And Product Improvement

Part I

Small and medium manufacturers are today faced with the urgent problem of successfully competing for markets in a comparatively uncontrolled or free economy. Those able to materially cut production costs and to gain competitive advantage through the introduction of improved or new products stand a far better chance of weathering any storm.

This paper describes a technique for attaining production economy and for improving products; one admirably suited to small and medium manufacturers whose financial resilience is small and who are further constrained by the limitations of plant facilities, manpower, and time.

Economic manufacture is achieved when there is maximum utilization of machinery and men and minimum expenditure of time and materials. To attain this state, management must:

a. Reduce the number of individual operations required and the time and motions of operators to a minimum.

b. Reduce idle machine time to a minimum.

c. Arrange for the number of moves to be as few, short and simple as possible.

d. Use the cheapest and least amount of materials consistent with quality requirements.

e. Reduce both the time and the frequency of material in storage or waiting.

This article discusses the methods of accomplishing the above. It is based on the fundamental premise that in even the best managed plants systematic study will reveal many handlings, operations, storages, etc., which contribute nothing to the worth of the product. By means of searching analysis and synthesis of production processes these wasteful nonessential elements can be determined and eliminated and the remaining essential ones then improved and simplified. Thereby, optimum productivity and minimum unit cost may be attained whether the process involved is an existing one or one still in the planning stage.

One of the best ways to discover and eradicate the costly inefficiencies is to first visualize concretely all elements comprising the production process and to then question each in a systematic and logical manner. For this purpose the Process Chart, Figure 1, has been found of inestimable value. The chart makes use of the five symbols shown in Table 1, Figure 2, which picture the major elements of any process: operation, move, temporary storage or delay, permanent storage, and inspection. It is constructed by following raw materials, components, or both, through an entire manufacturing procedure or portion thereof, listing each step as it occurs and including the distance of each move

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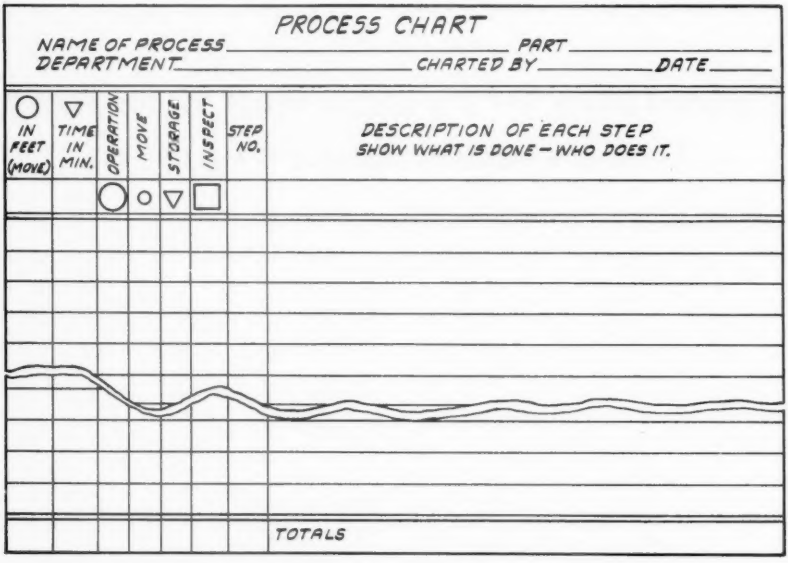


Fig. 1. The Process Chart depicts the major elements of any and all production processes to which a given piece-part is subject. Properly used, it often discloses glaring discrepancies in the ratio of productive operations and handlings to those of a non-productive nature; it can be used to take the "necessary" out of what may have been accepted as a "necessary evil."

and the time of each delay as determined by an ordinary pocket watch. The symbols are joined, forming columns, each column representing a different part. Merging columns indicate an assembly. The chart should be made by actually following the material through the plant and not from a desk, for the very act of closely observing each step will generally disclose conditions the existence of which was not formerly realized.

For use in conjunction with the process chart, a Flow Diagram should be prepared, thus giving a complete and detailed picture of the entire process. This chart is a simple floor plan layout indicating the position of equipment, machines, and materials with the actual flow of the process superimposed on it. Thereby, the progress of the material through the plant is shown, permitting such inefficiencies as backtracking, excessive length of movement, improper machine grouping or location, improper layout, etc., to be clearly visualized.

After the charts are drawn, each step should be closely examined to determine whether or not it is actually necessary. Particularly is this important with regard to moves and storages. A significant portion of production cost is made up of movement and handling, pickups, put downs, carrys, all of which add nothing to the worth of the product. Similarly, unnecessary storages are entirely too common in industry. The writer has observed that in many plants approximately 90% of total time in process occurs in the form of storages and delays. Elimination of these idle periods permits a higher materials turnover with lower investment in in-process inventory; less handling, spoilage, clerical control, etc.; and in improved customer relations through quicker deliveries.

TABLE I

SYMBOLS USED ON PROCESS CHARTS TO DENOTE PROCESS ELEMENTS.

SYMBOL	DEFINITION
○	OPERATION; E.G. LOADING ON TRUCK, DRILLING HOLE, SANDING PART, ETC.
⇨	MOVE; E. G. CARRYING, MOVING MATERIAL BY CART, MOVING BY ELEVATOR, DOWN CHUTE.
▽	PERMANENT STORAGE; E.G. STORED IN STOCK ROOM, CRIB, PARTS STORES, ETC.
D	TEMPORARY STORAGE OR DELAY; E.G. MATERIAL IN CART AT MACHINE WAITING TO BE PROCESSED, MATERIAL WAITING TO BE MOVED.
□	INSPECTION; E.G. GAGING, GRADING, CHECKING FOR COUNT, CHECKING QUALITY.

Fig. 2. The symbols used to animate a Process Chart. After the symbols have been evaluated in units of time in the making of the Process Chart they are used to prepare a Flow Diagram which, in its meandering and backtrackings, spurts and stalls, may demonstrate the need and economic justification for a complete modernization and revision of a manufacturing operation; from engineering to fabricating, from toolroom to special machines, from heat treating to shipping platform.

In this connection, the importance of developing a questioning attitude, one which takes nothing for granted but which probes to the heart of the problem, must be emphasized. Processes have a habit of mushrooming with elements often tacked on haphazardly while others are performed merely because "we've always done it." To the casual observer, bound by habit and tradition, such processes appear natural and proper. The manufacturer will find it more profitable, however, to look beyond the obvious and to critically examine facts relating to his production methods; to ask "why" even when the answer appears superficially apparent.

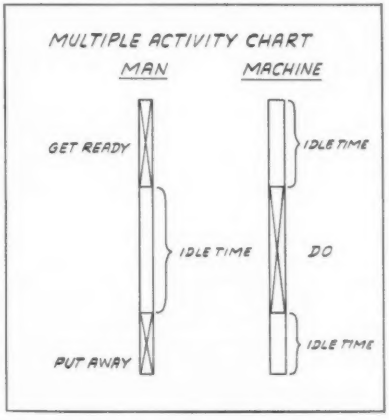


Fig. 3. Following the design, manufacture and application of production tooling, the resultant machine operations can be analyzed as shown. Usually machine is idle during "Get Ready" and "Put Away" increments, while operator may be idle while machine is performing its "Do" sequence. Simultaneous study of Multiple Activity Charts and the Flow Diagram can facilitate a reduction in idle time by means of better tooling, operations sequence or machine grouping, singly or in combination.

After the elimination of the non-essential steps, the necessary ones are further reviewed to see whether additional economies can be effected through combination of elements, improving the sequence or simplifying the steps. In this connection the following check lists will be found helpful in analyzing the steps shown on the process chart:

(a) Move

1. What is number of moves? Combined distance? Combined time?
2. Is each move necessary?
3. Could move be eliminated by changing layout, work sequence, equipment, methods, or by installing conveyors?
4. Could moves be combined by altering sequence, layout, quantity moved?
5. Can moves be shortened, simplified, improved?
6. Are moves performed by appropriate persons?

(b) Temporary Storage or Delay

1. What is number of delays and time

involved? Is ratio of delay time to total process time high?

2. Can delays be eliminated or shortened by better scheduling; change in sequence, or size of material "banks"?

(c) Permanent Storage

1. Is it necessary?
2. Are stores properly located? Are central stores advisable?
3. Can procedure for getting materials from stores be improved or quickened?
4. Are storage conditions satisfactory?

(d) Inspection

1. Is each inspection necessary? Suppose it were omitted? Is there duplication?
2. Can inspections be combined with each other? With packing, sorting, assembly?
3. Is it performed at best point in process, in best location, by most suitable person?

(e) Operation *(only step adding to worth of product)*

1. Why is each necessary? Can it be eliminated by changing layout or equipment?
2. Can two or more be combined?
3. Can sequence be improved?
4. Can operation be simplified?
5. Is each performed in best department?

Bear in mind that improvements are brought about by the observer, not by the charts. They form an effective management tool but, like any other tool, best results are obtained when used with skill and intelligence.

With the process charts as a base, the major factors influencing manufacturing efficiency can be examined. These are: Product Design and Materials; Materials Handling and Layout; Machinery and Equipment; Work-place Layout and Motions; and Working Conditions. Because of space limitations these factors are discussed for the most part in the form of check lists.

Product Design and Materials

Since manufacturing procedures are broadly determined by product design, the logical starting point is to review the design from the standpoint of the production problems raised. Even to the contract manufacturer, whose control over design is incomplete, this discussion is pertinent because of the considerable savings which are thereby made possible.

With available equipment in mind, the following general questions should be asked:

(a) Is design consistent with good manufacturing practice? Does existing equipment fit production requirements?

(b) Can number of parts be reduced? Is a particular part necessary? Can it be combined with another?

(c) Can standard or existing parts be used? Can parts be fabricated from standard stock?

(d) Can number of sizes and styles be reduced?

(e) Are specified tolerances, allowances, finish actually required?

(f) Could design modification simplify removal of castings from molds or dies? Removal of flash, gates, sprues? Simplify finishing operations?

(g) Can design change avoid or simplify assembly? Avoid special fitting, filing, etc.? Are assembled parts interchangeable?

(h) Will design change permit simpler casting or molding methods or dies? Permit use of jigs or fixtures instead of hand work? Fewer rejects?

(i) Are quality specifications appropriate?

Lest the economies which may accrue from designing from the production standpoint be underestimated, the savings which may be expected from simplification and standardization alone are sufficient to make such a study worthwhile. Some of these are: less raw materials, in-process, and finished stock inventory; longer, smoother production runs; quicker processing; less supervision, paperwork, total set-up time; improved delivery schedules.

Materials

To insure the most effective and economical materials utilization, the following check list is suggested:

(a) Is material functionally suitable?
(b) Could cheaper material be used?

Could it be purchased instead of fabricated?

(c) Is size, gauge and unit of purchase most economical?

(d) Is condition at delivery satisfactory? Free from dirt? Uniform? Properly graded? Proper quality?

(e) Would use of different material cut out some operations or reduce processing time?

(f) Is waste kept to minimum? Is material salvageable?

Materials Handling and Layout

Good layout and materials handling promote smooth and rapid flow of work, whereas poor layout and handling produce inefficiencies. The process charts offer the small manufacturer a simple means for studying this phase of production, a phase offering great opportunities for cost reduction. Check the following:

(a) Is backtracking (horizontal and vertical) minimized?

(b) Is route of material shortest and simplest?

(c) Do steps naturally follow one another? Is flow toward shipping?

(d) Is distance operator moved to get or to lay aside material a minimum?

(e) Is easiest and most appropriate material moved?

(f) Is movement facilitated as much as possible?

(g) Can pick-up at one operation be simplified by manner of disposal as previous one?

(h) Can machines be grouped to minimize movement of materials and/or operators? To minimize idle machine and operator time?

(i) Can progressive assembly line be set up for portion of process?

(j) Can machines, stores, etc., be placed to reduce handlings and distance moved?

(k) Can gravity chutes or rollers be used? Between workplaces; floors; to and from stores?

(l) Can last operation be combined with packaging?

(m) Can ratio of handling to processing time be reduced?

(n) Can hand or electric trucks, special racks, carts, or trays be used?

(o) Would conveyor prove economical? Can operations be performed on it? Can it integrate assembly, inspection, packing, shipping?

(p) Is it easy to get and place materials on conveyor?

(q) Is job rating of move men appropriate?

(r) Is pick-up schedule adequate and definite?

(s) Can amount moved be increased or decreased advantageously?

(t) Is material container appropriate? Does it permit easy access?

(u) Is layout and handling system flexible?

Machinery and Equipment

To insure maximum utilization of machinery and equipment analysis is made in a similar manner. The following sample questions are offered:

(a) Are machines and equipment used most suited to process requirements? Is machine too big or small for job?

(b) Is each machine fully utilized? Could use be made of idle machine time?

(c) Is buying other equipment advisable?

(d) Is each machine in good operating condition? Properly maintained?

(e) Can efficiency be improved by special coloring of machine parts?

(f) Are tools, jigs, fixtures suitable? Could use of others improve or simplify work? Can multiple fixtures be used?

(g) Are tools, dies, cutters in good operating condition?

(h) Should special set-up man perform machine set-ups or should operator do them?

Working Conditions

To provide working conditions conducive to efficiency, check for the following:

(a) Is light ample, uniform and of right kind?

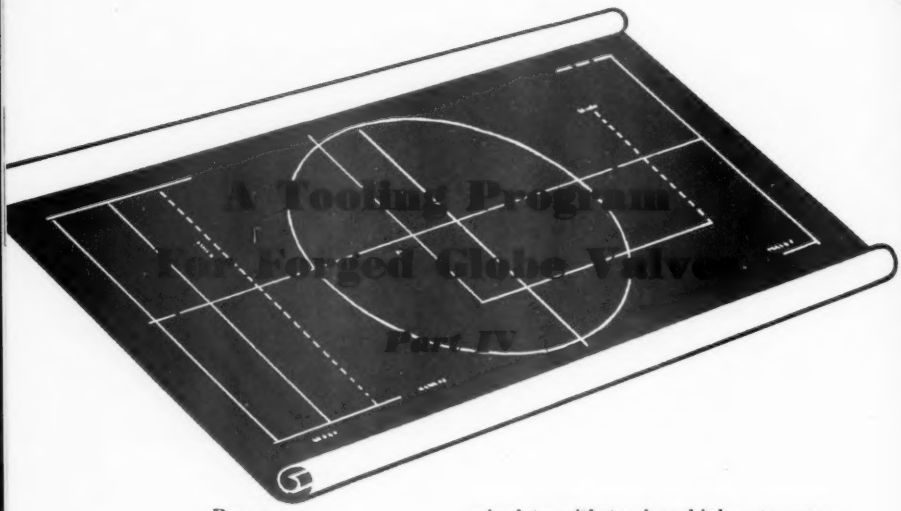
(b) Are colors of machine, walls, ceilings, etc., appropriate?

(c) Are heat and ventilation adequate?

(d) Can noise be reduced?

(e) Are washrooms, lockers, etc., adequate and suitably located?

(CONTINUED ON PAGE 140)



A Tooling Program for Forged Globe Valves

Part IV

Resume

Inasmuch as this article describing the manufacture of a Parker brass offset globe valve body is appearing in four parts, a brief resume of the first three parts will assist in answering some of the questions which have arisen from our readers. The first part appeared in the November issue and dealt with the design and construction of the master die. Emphasis was placed on the care exercised in cutting keyways used in positioning the master die blocks for subsequent operations in constructing the forging dies.

The second part appeared in the December issue and explained the steps in the construction of the forging and trimming dies, the forging process and the trimming of the flash from the forging blank.

In discussing the steel used in the insert die block and trimming dies, the elements necessary to meet the operation requirements and specifications of the Parker Appliance Company were omitted. For the insert die, a steel containing carbon, chromium, tungsten and molybdenum is specified in percentages to produce a steel which will withstand high temperatures without developing heat cracks.

A steel containing carbon, manganese, chromium, nickel, and molybdenum is used for the die block, which is not required to withstand as high a temperature as the insert. For the trimming die, a carbon, manganese, silicon, chromium, nickel and molybdenum steel is used.

Figure 10 shows a 1000-ton Minster forging press and a Morrison furnace. This furnace is used for heating aluminum slugs to 900° F for forging, while a Lindberg furnace, not shown in the photograph, is used for heating brass slugs to 1500° F. These two furnaces have different temperature ranges.

by Carl F. Benner
Assistant Editor

Figure 11 illustrates a heated slug positioned over the anvil die. One stroke of the hammer die will form the valve body in Figure 12. Many Parker brass and aluminum valve body forgings are completed with one blow of the hammer die; however, there are some valve body sizes and materials which require more than one blow.

The thickness of the flash at the flash

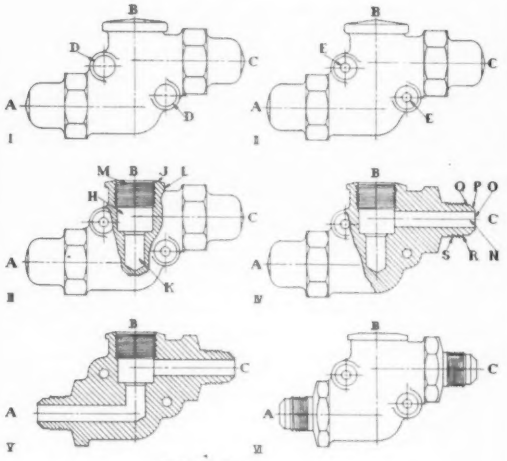


FIGURE IG

Fig. 16. Six views of the forged brass offset valve body, showing the various steps in the machining program. Cross hatched sections indicate completed machining. I, first operation, milling surfaces of mounting bosses; II, second operation, drilling holes in mounting bosses; III, third operation, drilling holes of two diameters, facing, turning and internal threading of valve port; IV, fourth operation, drilling, facing, turning and external threading of outlet port, C; V, fifth operation, fourth operation is repeated on outlet port, A; VI, valve body machining completed.

line for this particular body size is ⅛".

This thickness of ⅛" is not standard for all forgings, but varies according to the size of the forging.

The third part details the machining of the mounting bosses and the drilling of the mounting holes. Accurate subsequent machining depends on the precision of the milling and drilling of the mounting bosses.

Machining Operations on Valve and Outlet Ports

There are three sets of machining operations performed on the offset valve body in which the Goss & DeLeeuw automatic chucking machine is used.

Because dimensions have not been shown on the drawings and the size of the valve has not entered into this discussion, any mention of drill or tool sizes is used only as relative comparisons, indicating different operations as taking place.

The first set of machining operations is performed on the valve port, III-B, Figure 16. These are: (1) drilling a $\frac{13}{16}$" hole $\frac{31}{32}$" deep, III-H, and facing the top surface of the valve port, III-J; (2) drilling $\frac{3}{4}$" hole $\frac{37}{32}$" deep, III-K, and turning the outside diameter of the valve port, III-L, to 1.312"; (3) counterboring the top surface of the valve port, III-J, and countersinking the edge of the opening III-B; (4) tapping a ⅞"-24 internal thread, Class 3, III-M.

The second set of operations takes place on outlet port, IV-C, Figure 16, and consists of: (1) drilling a $\frac{53}{64}$" hole 1½" deep, IV-N, facing end of port, IV-O, and rough turning seat, IV-P; (2) drilling the $\frac{53}{64}$" hole to a final $2\frac{7}{16}$" depth. IV-N, finish turning approach to threads, IV-Q, and continued rough turning of seat, IV-P; (3) finish facing end of

Fig. 20-a. Goss & DeLeeuw Automatic Chucking Machine Department.

port, IV-O, finish turning of seat, IV-P, and chamfering for first thread, IV-R; (4) cutting ¾"-16 external threads, Class 3, IV-S.

The third set of operations, a repetition of the second, is performed on outlet port V-A, Figure 16.

These three sets of machining operations are worked on a No. 6 Goss & DeLeeuw automatic chucking machine, Figure 20-a. On this machine the tools revolve and the whole turret head, on which chucks are mounted, moves the work into the tools. It is a four-spindle machine so arranged that individual spindle speeds are obtained through pick-off gears. Thus each tool can operate at its correct cutting speed. Five chucks are mounted on the turret head in equally spaced positions. This arrangement provides for the simultaneous machining of four valve bodies through the successive operations, with one chuck and index position free for loading and unloading. This Goss chucker does not have a cross slide so that all operations are performed from end working tools. Turning, facing, and chamfering operations are made with overhanging tool bits inserted in special tool holders set in the selected spindles.

Figure 20 shows a Goss & DeLeeuw chuck with a valve body clamped in position and ready for machining. These chucks are standard equipment with the Goss & DeLeeuw machines. Special holding pads are designed and built by the Parker Appliance Company to accommodate the particular part to be machined and then bolted to the jaws of the chuck. In this setup, pad X-1, Figure 20, is stationary, being bolted to the

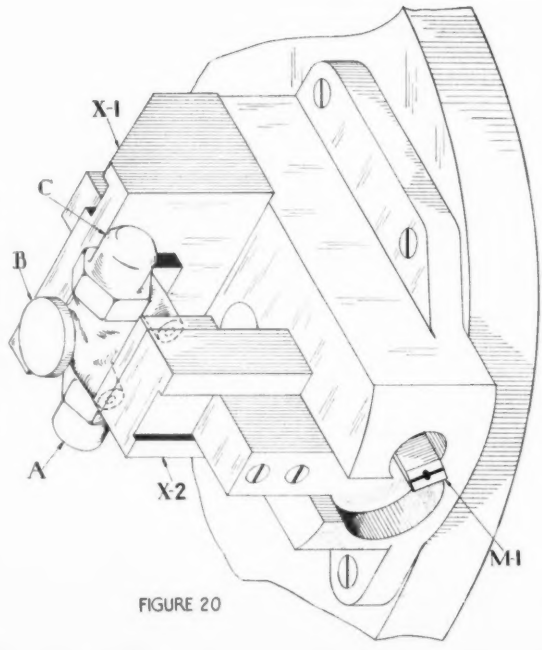


FIGURE 20

Fig. 20. Valve body mounted in a Goss & DeLeeuw Chuck, positioned for the machining of the valve port, B. The X-1 pad is stationary, being bolted to the base of the chuck. Pad X-2 is bolted to the jaw of the chuck and moves in and out by rotation of screw M-1.

base of the chuck, while the front pad, X-2, bolted to the jaw of the chuck moves in and out when actuated by screw M-1. The screw is rotated by means of a crank wrench mounted on the machine in such a position as to freely engage with the head of screw M-1 when a chuck has been indexed to the load and unload position.

The chuck in Figure 20 is set up for the machining of the valve port, B. The tools installed in each of the four spindles are shown in Figure 20-b in the order in which they perform their operations. The first is a drill and facing tool mounted in a Parker designed holder, the second is a drill and turning tool also mounted in a Parker designed holder, the third is a formed counterbore and countersink, and the fourth a tap.

The Parker designed tool holder and overhanging cutting tools used with it permit the setting of the tools in a wide range of positions so that straight or angular cuts can be made. The first operation on the valve port is drilling and facing the top surface of the port, III-J, Figure 16. To complete this operation without leaving a burr at the edge of the drilled hole, the facing tool is set so that its point extends into one of the flutes of the drill, thereby bringing the cutting edge of the tool and the flute of the drill into a position which prevents the formation of a burr.

The cycle of operations is: (1) load valve body in chuck, tighten chuck, index automatically; (2) drill, III-H, and face surface, III-J, Figure 16, with tool in first spindle, index; (3) drill III-K and turn edge, III-L, with tool in second spindle, index; (4) counterbore a slight angle on surface, III-J, and countersink inside edge of drilled hole, III-H, with formed tool in third spindle, index; (5) cut internal threads, III-M, with tap in fourth spindle, index; (6) unload machined body and load a new body.

The operations in this cycle take place on one body as the turret indexes from

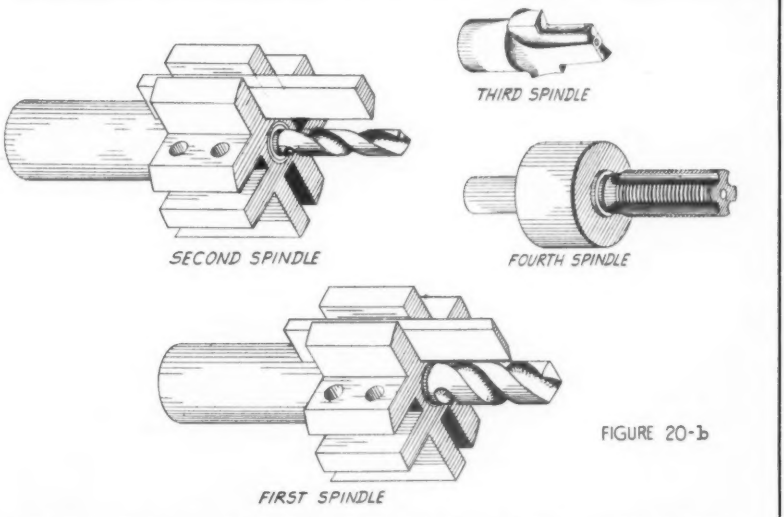


Fig. 20-b. Tools mounted in the four spindles of the Goss & DeLeeuw chucking machine for machining the valve port.

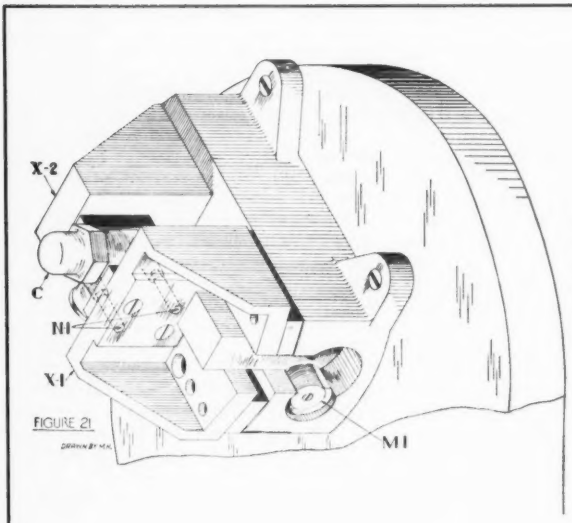


Fig. 21. Valve body set up in chuck for machining outlet port C. Locating pins, N, are shown in the stationary pad.

station to station. When the five chucks are loaded and the machine is in full operation, four bodies simultaneously are having one of these successive machining operations performed on them.

The next step in the machining operations on the Parker offset valve body is that performed on the outlet ports. Figure 21 shows a valve body set up in a Goss chuck ready for the machining of one of the outlet ports, C. In this figure N-1 indicates the locating pins in the stationary chuck on which the valve body is placed by means of the drilled holes in the mounting bosses II-E, Figure 16. The position of the valve body in the chuck for this operation is different from that for the machining of the valve port, therefore a different set of pads had to be constructed.

The tools mounted in the four spindles of the Goss automatic chucking machine for the operations on the outlet port, C, Figure 21, are shown in the order of their application in Figure 22. Also shown is the shape of the port after each successive operation. The first spin-

Fig. 23. Nut and sleeve parts for making a tubing fluid seal to an outlet port having a 30° angle external nose or seat.

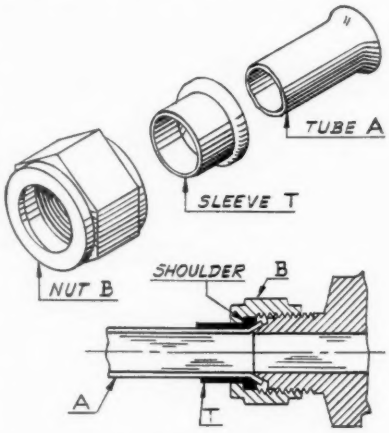


FIGURE 23

DRAWN BY M.K.

CTW
A CHAIN IS AS STRONG AS ITS WEAKEST LINK
A MACHINE IS AS GOOD AS ITS CUTTING TOOL...
Specify CONTINENTAL
The precision cutting tool must be even more accurate than the machine, the fixture, or the finished part. "Continental" cutting tools made by Ex-Cell-O (they run from a standard counterbore to all types of broaches and to special carbide-tipped tools of intricate design) are acknowledged to be among the best obtainable in design and manufacture and in actual production results.
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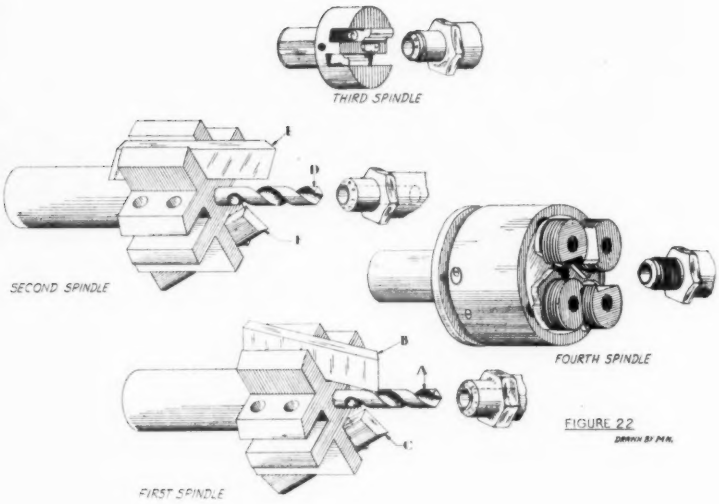


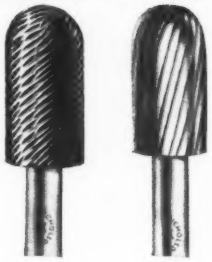
Fig. 22. Tools mounted in the four spindles of the Goss & DeLeeuw Chucking Machine. These tools perform the machining operations on the outlet ports. A Parker designed tool holder is mounted in the first spindle with a drill and two overhanging tools inserted. With this arrangement drilling, facing, and rough seat turning operations are performed simultaneously. Tool B is set with its point extending into the flute of the drill so that a burr is prevented from forming on the edge of the drilled hole. The second spindle carries a similar setup of tools except that an O D turning is performed instead of the facing. The third spindle has a tangent tool which finish faces the end of the nose, finish turns the seat, and chamfers for a first thread. A threading die is mounted in the fourth spindle for cutting an external thread. Sections of the outlet ports indicate the operations performed.

dle carries a Parker designed tool holder with a drill, A, a facing tool, B, and a seat turning tool, C, inserted; the second spindle also has a Parker holder with a drill, D, an OD turning tool, E, and a seat turning tool, F, in place; the third spindle has a tangent tool for finish facing, turning and chamfering; and the fourth spindle carries a threading die.

The tangent tool set in the third spindle has been specially designed by Parker engineers. It finish faces the end of the port, finish turns the seat and chamfers for the first thread in one operation. Specifications require that the seat and threads of the outlet ports be concentric with the axis of the port opening. Therefore, to accomplish this, the tool is provided with a pilot which

(CONTINUED ON PAGE 144)

NOW BOTH TYPES IN BOTH SIZES



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POINT No. 2

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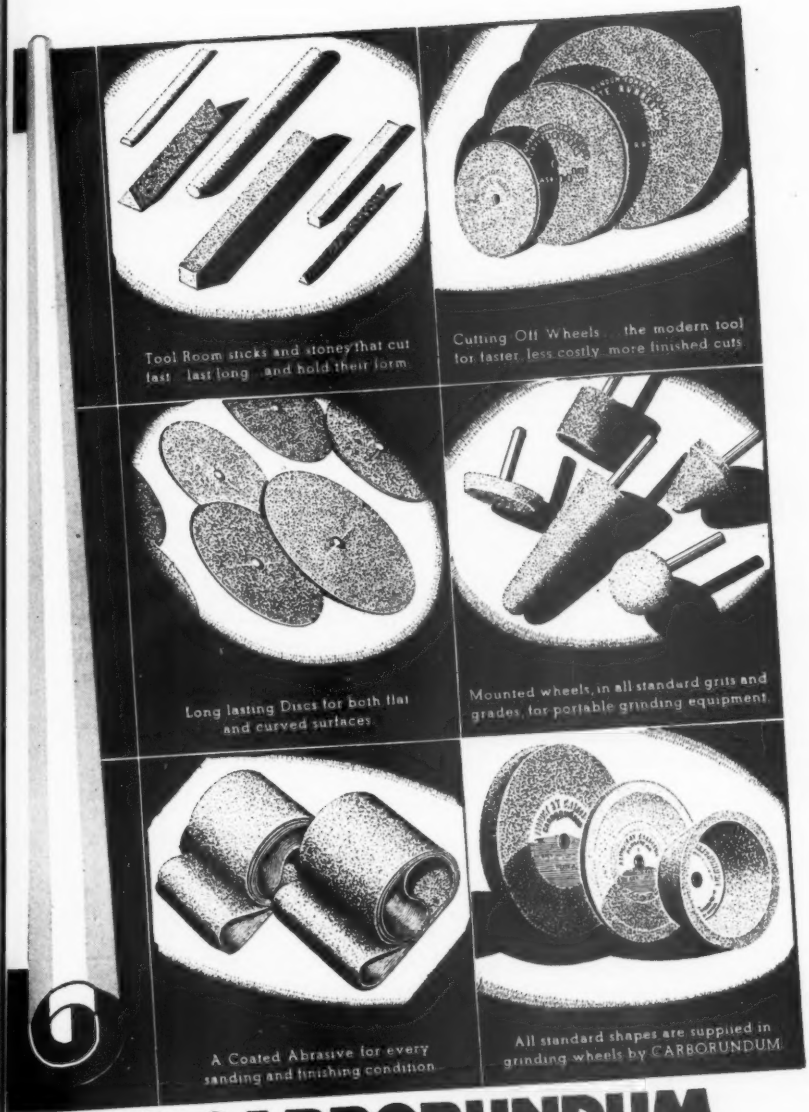
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Hydraulic Applications From The Users' Viewpoint

Editor's Note: This is our second feature presentation on hydraulics know-how from the recent Machine Design Conference of the Cleveland Engineering Society. For the first, on "Hydraulic Valves and Control Devices", see TOOL & DIE JOURNAL, November 1946 and January 1947. The other subjects on pumps, power units, oils and circuit calculations will follow in early issues.

Constructive Criticisms of Hydraulic Installations

As many of the people in the audience know, I started about three years ago, through talks to technical societies, engineering departments of machine tool builders and, in one case, to a meeting of the National Machine Tool Builders Association, to criticize the selection and installation of electrical and hydraulic equipment on machine tools. After considerable discussion among the executives at our Central Office and the Master Mechanics and Plant Engineers of our various Divisions it was decided at that time that this was the best method to use to bring to the attention of the machine tool builders and the manufacturers of electrical and hydraulic equipment the difficulties encountered with this type of equipment in our plants. Through this approach we naturally expected to eventually get better machine tools, particularly from the maintenance angle, and to achieve this goal it was necessary that everybody concerned consider our comments as constructive criticism and make every possible effort to correct the points brought to their attention.

Cooperative Engineering of Electrical Equipment

In the case of electrical equipment the manufacturers have done a splendid job in producing equipment better fitted for use in high production plants than that formerly furnished. The electrical engineers in the machine tool builders' plants have also cooperated to the highest degree in redesigning the installation of electrical equipment. As a result of this close cooperation between the manufacturers of machine tools, the manufacturers of electrical equipment and the purchasers of machine tools, the down-time and maintenance costs due to failure of electrical equipment have been considerably reduced over the past year.

by H. T. Johnson
Director Facilities and Equipment
Process Development Section
General Motors Corporation

Need For Cooperative Hydraulic Engineering

I know that a great deal more can be accomplished on hydraulic equipment by the same sort of cooperative effort on the part of everybody interested in such equipment. In fact, we in General Motors intend to start an hydraulic activity in the near future patterned after our conferences with the machine tool builders, the electrical motor and equipment manufacturers and other large users of machine tools. I sincerely hope that our efforts will be accepted by everybody concerned as we intend them.

I hesitated for quite a while before I accepted the invitation to talk at this conference due to the unfavorable reaction of several people after some of my previous talks. I have either been badly misunderstood or deliberately misquoted. In spite of the fact that the remarks I have made in the past were the result of contacts with the maintenance personnel in our plants I was accused of giving only my own personal opinions. I have been accused of making untrue statements and of also stating that hydraulics in general had no advantages and would be replaced by mechanical methods.

Source of Criticism

In order that everybody at this meeting may understand my position perfectly I want to make a few statements at this point:

1. All of the statements I have made in the past and those I will make today are based on accurate information received from our plants. We have 39 Divisions and over 100 Plants. These plants use well over 100,000 metal cutting machine tools and presses. I honestly believe that our experiences with machine tools and other equipment represent a good cross section of the experiences of most users of hydraulic and other equipment.
2. I have definitely stated in all of my talks, and I emphasize it again today, that my comments refer to the use of hydraulics on machine tools and presses only. I am not familiar with the installation of hydraulic accessories in other types of equipment, and therefore cannot make any comments on their use.
3. I have never made a statement to the effect that hydraulics generally are no good and are on the way out, although I have been quoted as making that statement. What I have said is that unless some phases of the application and installation of hydraulic equipment are cleaned up, there will be a resistance on the part of shop personnel to the use of hydraulically operated machine tools. Due to inaccessibility of hydraulic equipment and leakage due to high pressures, both of which result in high maintenance cost, this trend has become quite apparent in our plants in the case of hydraulically operated presses.

I hope that everybody clearly understands these three points and that if I am quoted it will be in accordance with these statements.

Hydraulic Engineering vs Installation

There is a very definite need for hydraulics in present machine tools but at the same time the selection and installation of hydraulic equipment require a great deal of thought. The manufacturer of hydraulic equipment must work closely with the machine tool designer and make certain that his equipment is installed in an efficient and accessible manner. Failure of hydraulic equipment reflects more on the manufacturers of the hydraulic equipment and on hydraulics in general than on the machine tool builder. Most hydraulic equipment is basically well engineered and well built but the installation of much of the equipment has not been well engineered.

Believing that this group would be interested in a summary of the comments of our plants on hydraulic equipment I have again contacted the people in our plants who are most interested in this type of equipment. I asked each of them for his opinion of present equipment. Almost everyone I talked with was of the opinion that hydraulically operated machine tools had been

Only new bortz diamonds, carefully crushed and graded by the special JKS process are used in making Secomet wheels. Extra life and clean, sharp cutting action are thus provided.

Grit sizes of 400 and coarser are available in metal, resinoid or vitrified bonds to provide proper surface for all types of tools. 500 grit and finer can be supplied for special applications.

Bonds are selected for their ability to hold diamond particles securely until completely consumed.

Straight cup, flaring cup, dish and other wheel types meet every production requirement for diamond wheels.

For all the facts, write for Bulletin 45A.

greatly improved over the past year but that there are still several places where greater improvements can be made.

Inaccessibility of Equipment

All of our plants are greatly disturbed regarding the inaccessibility of pumps, valves, piping, etc., in present machine tools. This results in excessive maintenance costs and long periods of downtime in cases of even minor repairs. I will enumerate some of the criticisms from our plants and in most cases I will quote the people contacted:

1. "Many machines have the pump and valves located in the oil reservoir. This makes it necessary to disconnect a great deal of piping and drain the reservoir before any maintenance work can be accomplished. In cases where solenoid valves are located in reservoirs there is, in addition, a safety problem and also in many cases the oil mist affects the operation of these valves."
2. In other cases pumps are hidden in the base of the machine and then surrounded with piping, making it necessary to break several joints in order to service the pump.
3. Feed cylinders are usually installed in such a manner that tables or slides must be removed in order to replace piston rod packings or repair oil leaks at pipe joints. In many cases the removal and replacement of a table or slide requires from 16 to 48 hours.
4. In many cases oil reservoirs are located in a machine so low that they cannot be drained but must be pumped out. This makes the draining and cleaning of reservoirs a lengthy operation.

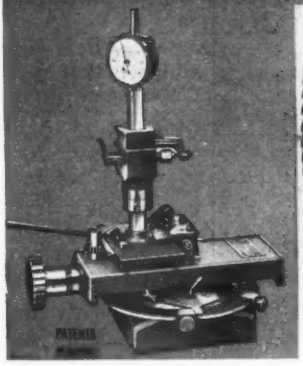
Suggested Improvements

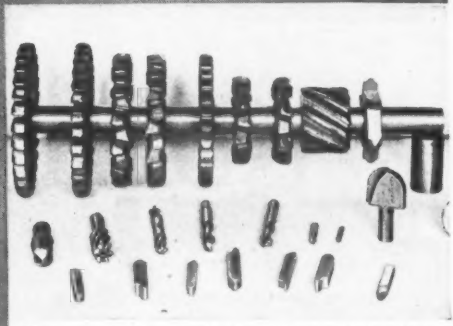
In order to remedy some of our difficulties caused by inaccessibility, several of our people had suggestions which they asked me to pass along to this group.

1. Most machine tool builders are now installing their electrical controls in a neat, accessible enclosure out-

(CONTINUED ON PAGE 132)

Is Your Tool Room a Bottleneck for Those Badly Needed Production Tools?





Here are a few standard cutting tools that have been ground on the radiform into special forms.

If your production is being delayed in your tool room, it will pay you to investigate the Radiform Wheel and Tool Former for simplifying your difficult tool grinding jobs. Radiform will save you time, money, and give you precision results you had never before hoped for.

With a Diamond Wheel, carbide tools are no more difficult to grind than high speed steel tools.

Write or wire for literature and prices today.

A number of good territories are open to qualified distributors.

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Noble & Stanton standards are preferred by those who demand the highest quality tooling.

Portfolio containing actual size drawings and prices will be sent on request.

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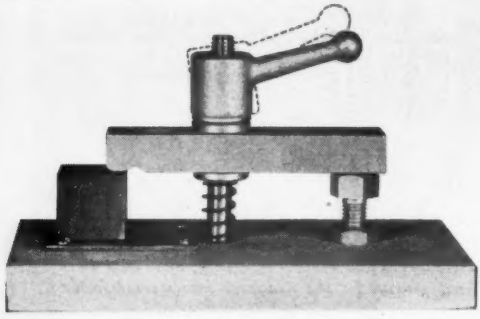

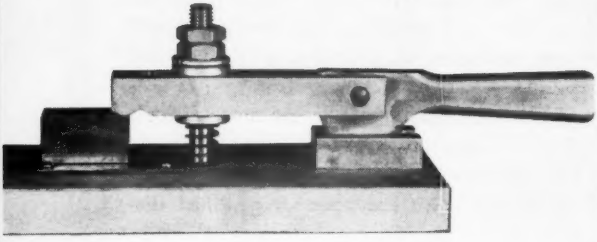

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Adjusting Head Screws
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Clamp Rests
Flange Nuts
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Ground Thread Studs
Heel Clamps

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QUARTER TURN "LIGHTNING" CLAMP ASSEMBLIES

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INDUSTRIAL DIGEST

Science • Research • Methods • Tooling • Production • Trade News and Reports

Standardization of Diamond Tool Holders

In line with a movement initiated by the National Bureau of Standards, the Diamond Tools Committee of the Industrial Diamond Association of America has met with representatives of machinery manufacturers. They discussed possibilities for simplifying the use of diamond tools for economy to users, through the collaboration of machinery manufacturers with producers of diamond tools, in standardizing the holders. This work is under the cognizance of the Division of Trade Standards, Washington, and it is expected that economy will result to the users of diamond tools, both through smaller inventories and time saved.

The Industrial Diamond Association is also surveying all its tool making members to determine from their experience what abuses there are in the use of diamond tools, to that end that consumers may be advised directly by I.D.A. of the best methods of obtaining the maximum utility, and to prevent uneconomical destructive abuses. It is planned eventually to issue a printed, illustrated manual. It is expected that the results of the survey will be analyzed, one type of tool at a time, so that publication can be made in trade journals of advance chapters of the manual, as and when the information is cleared by the various committees of the association.

"Friction Metallurgy"

Metallurgical as well as geometrical changes can be brought about in lubricated steel surfaces by friction, when two hard steel (or cast iron) surfaces slide over each other, Bernhard W. Sakmann, research engineer with the Carter Oil Company, Tulsa, Okla., formerly of Massachusetts Institute of Technology, reported in a paper at the applied mechanics session of the 67th Annual Meeting of The American Society of Mechanical Engineers. This was said to be the first time such changes, determined in a series of laboratory tests, have been reported.

Mr. Sakmann described experiments made by the engineering division of the Chrysler Corporation to discover changes taking place in steel surfaces during running-in. Tests simulated conditions encountered in industrial practice. He found that in all tests the geometry of the surfaces was changed, the nature of the change depending on the original surface finish of the test specimen. Initially rough surfaces were flattened, smooth surfaces were roughened. Geometrical changes were more conspicuous for rough surfaces than for smooth friction flats.

Running-in tests were performed on a friction test machine which consisted of a disk rotating at constant speed. The stationary flat test specimens were pressed against the disk.

In the first group of tests friction flats of various steels and cast iron of medium hardness were run in against a babbitted or antifriction alloy surface. Only geometrical changes were observed when surfaces were run against a soft bearing material.

In the second group of tests hard surfaces of alloy steels and cast iron were run in against cast iron and alloy steel. They showed the same geometrical changes as in the first tests. In addition they revealed that when two hard surfaces are run against each other

metallurgical changes take place.

Transformed material was found to be considerably harder than the martensitic steel of the test samples, and the etching characteristics of the transformed material were markedly different from those of the underlying steel. Initially smooth surfaces took the form of ridge-like eruptions protruding over the surface of the friction flats by several microns (thousandths of a millimeter). Three regions could be distinguished in the transformed surfaces. They were bulk steel, transformed material, and intermediate transition region.

Changed specimens were etched with more than a dozen different etching reagents to identify the transformed material. All tests indicated that transformed material consists of a carbide-rich phase.

Cutting Tool Manufacturers' Association

A labor program designed to eliminate grievance strikes by calling for compulsory arbitration of grievances, legislation to equalize the position of management and Unions at the bargaining table and government seizure on negotiation cases, where necessary to protect the public interest, was adopted at its annual meeting by the Cutting Tool Manufacturers' Association.

The three basic provisions of the recommended program are:

1. Adoption of legislation making it possible for employers to come to the bargaining table on an equal footing with Unions.
2. Setting up of special Labor Courts to hear appeals on grievance cases. The decision of these courts would be binding on both parties and would tend to eliminate all strikes due to "grievances".
3. Setting up of special Wage Courts or Commissions to hear and issue decisions on appeals regarding wage disputes and other questions subject to negotiation. While the decisions of these courts or commissions would not be binding they would pave the way to government seizure of a plant where the public interest is involved. Legislation to permit such seizure in the public interest is advocated by the C.T.M.A.

The program was presented to the C.T.M.A. as a body by Howard Simon, legal counsel for the organization, and was adopted by resolution with the recommendation that a copy of the complete report should be supplied to each member of the Michigan congressional delegation.

E. A. Goddard, Vice President of the Detroit cutting tool firm of Goddard and Goddard was elected President of the C.T.M.A. and R. H. Wolfe, President of Arrow Tool and Reamer Co., Detroit, was re-elected Treasurer. D. E. Van Deusen, President of Kelly Reamer Company of Cleveland, Ohio, was elected Vice President.

New directors elected for a three-year term were: Emil Gairing, President, Gairing Tool Company, Detroit; Malcolm F. Judkins, Chief Engineer, Carbide Division, Firth-Sterling Steel Company, McKeesport, Pa.; John K. Penny, President of U. S. Broach Company, Detroit; as well as Mr. Goddard and Mr. Van Deusen.

Office of Technical Services

More than 200 businessmen, manufacturers, and others call upon the Reference Service of the Office of Technical Services, Department of Commerce, each day for help in tracking down technical data contained in the 40,000 reports on sale by the Office. John C. Green is OTS Director.

OTS is the clearing house for all scientific and technical reports from both American and foreign sources, which are available within the Federal Government. Reports are obtained from other Federal agencies; from investigators sent overseas by OTS to study production processes, materials, and equipment in Germany and former German-occupied countries; and through exchange with England and other foreign countries.

Many of the reports have only recently been removed from the "secret" category. All are screened by the armed

services for security reasons before they are placed on sale to the public by OTS.

Inquiries may be made by telephoning District 2200, Ext. 1630, or by writing to the Reference Service Section, Office of Technical Services, Department of Commerce, Washington 25, D. C.

Bearing Industry Backlog

Peacetime reorganization of industrial plant machinery and a vast backlog of unfilled orders for consumer goods in 1947 will create one of the greatest demands in history for anti-friction ball and roller bearings has been predicted by H. O. Smith, Secretary of the Anti-Friction Bearing Manufacturers' Association.

In scores of types of productive machinery, the number of anti-friction bearings has trebled or quadrupled to meet the need for higher speeds and greater strength and accuracy, Mr. Smith said in a year-end review. Begun under the stress of war, this trend is continuing at an expanding rate.

Many industries, which in 1940 were moderate bearing consumers, are now major markets and are absorbing a greater share of the ball and roller bearing output. Typical of such industries are textiles, earth moving equipment, machine tools, farm equipment and railroads.

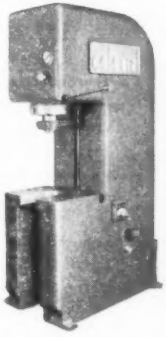
With the automotive builders, these industries alone accounted for a major share of the $220,000,000 in anti-friction bearing production in the past 12 months. In the textile field, demand for new synthetic fabrics and greater output of all textiles is forcing a general changeover to higher speed ball and roller bearing equipped machinery in hundreds of plants for the first time.

In 1940, with the exception of crack luxury trains, most railway passenger cars and virtually all freight cars, rolled on plain friction type bearings. Today, approximately 3,000 new passenger cars on order are being equipped with roller bearing journals to provide smoother riding and to eliminate hot box delays. In addition, anti-friction bearings are being installed on large numbers of express freight cars for the first time.

HYDRAULIC PRESSES

If you need an hydraulic press in the range of 1 to 50 tons—for assembly work, for straightening, for broaching, forming, punching, for work on plastics or aluminum and magnesium, you'll find it in the COLONIAL line. "JUNIOR" Presses in bench or pedestal types (1 to 4 tons; Bulletin VJ-1); UTILITY Presses available with or without speed, pressure, and dual safety controls (4 to 10 tons; Bulletin VBS); ASSEMBLY Presses—available with speed and pressure control (10 to 50 tons; Bulletin PA); STRAIGHTENING Presses with single or dual rail (15 to 50 tons; Bulletin PS); also hydraulic POWER PRESSES custom designed to the job, with plain or special hydraulic circuits, indexing mechanisms, special fixtures, etc. Straightening and pull-down broaching attachments also available on smaller presses.

JUNIOR PRESS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As you know, a cupola can be charged with materials to produce the type of castings desired — that is, if the metallurgist understands what materials to specify.

We can give ***Strenes Metal*** a considerable range of characteristics by certain changes in the formula. This affords unusual flexibility in adapting ***Strenes Metal*** castings to the work they are required to do.

So, if you need a special hardening quality in a die, we can give it to you with ***Strenes Metal;*** or we can give you what you need in machinability, or toughness, or any reasonable combination of properties.

This is one of the reasons why more and more manufacturers of metal products are using ***Strenes Metal*** dies. If you're interested, we'll be glad to answer your questions.

THE ADVANCE FOUNDRY CO.
DAYTON 3, OHIO

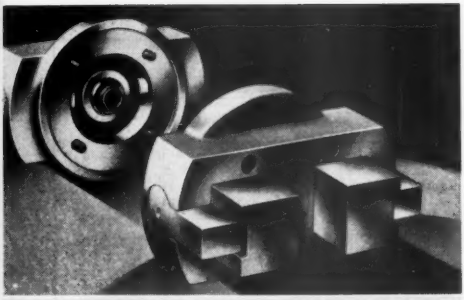
TDJ SHOP DATA SHEET NO. 58

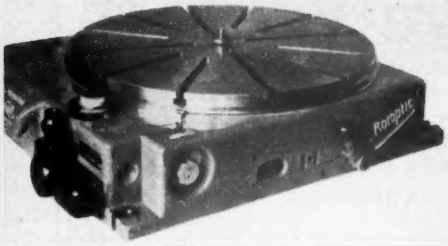
Approximate Blank Diameters for Drawn Shells (inches)

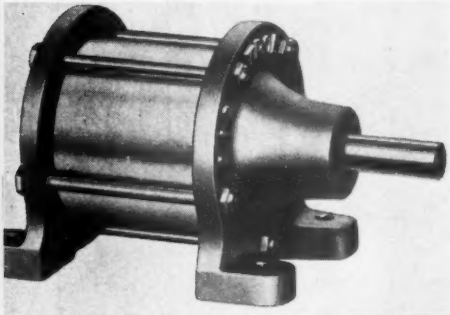
SHELL DIAM. (inches)	DEPTH OF DRAW (inches)					
	5.000	5.250	5.500	5.750	6.000	6.500
6.250	12.80	13.05	13.28	13.52	13.74	14.19
6.500	13.12	13.37	13.61	13.85	14.08	14.53
6.750	13.43	13.68	13.93	14.17	14.40	14.86
7.000	13.74	14.00	14.24	14.49	14.73	15.19
7.250	14.05	14.31	14.56	14.80	15.05	15.52
7.500	14.36	14.62	14.87	15.12	15.37	15.85
7.750	14.66	14.92	15.18	15.43	15.68	16.17
8.000	14.96	15.23	15.49	15.74	15.99	16.49
8.250	15.26	15.53	15.79	16.05	16.31	16.80
8.500	15.56	15.83	16.10	16.36	16.62	17.12
8.750	15.86	16.13	16.40	16.66	16.92	17.43
9.000	16.15	16.43	16.70	16.97	17.23	17.74
9.250	16.44	16.72	17.00	17.26	17.53	18.05
9.500	16.74	17.02	17.29	17.57	17.83	18.36
9.750	17.03	17.31	17.59	17.86	18.14	18.66
10.000	17.31	17.60	17.88	18.15	18.43	18.97
10.250	17.60	17.89	18.18	18.46	18.73	19.27
10.500	17.89	18.18	18.47	18.75	19.03	19.57
10.750	18.18	18.47	18.76	19.04	19.32	19.87
11.000	18.46	18.76	19.05	19.33	19.62	20.17
11.250	18.74	19.03	19.33	19.62	19.90	20.46
11.500	19.02	19.32	19.63	19.92	20.20	20.76
11.750	19.32	19.61	19.90	20.21	20.50	21.05
12.000	19.59	19.89	20.20	20.49	20.77	21.35

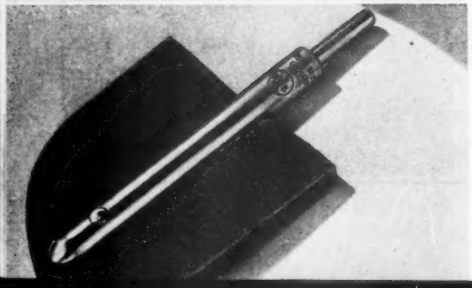
PROGRESS

NEW DEVELOPMENTS • IMPROVEMENTS • COST AND TIME SAVERS









FOR FURTHER INFORMATION FILL IN KEY NUMBERS ON POSTAGE-FREE INFORM-A-GRAM INSERT

ESPECIALLY DESIGNED FOR PRODUCTION WORK on objects of irregular shape, such as valve parts and pipe fittings, Series 1400 and 1400A box-body chucks are again being made by the Skinner Chuck Co. Simply constructed of only a wedge and two jaws operating on the collet principle, this chuck has a semi-steel body bridged against springing. Get additional information from SKINNER CHUCK CO., Dept. 69, 344 Church St., New Britain, Conn., or use INFORM-A-GRAM Key No. F69-U.

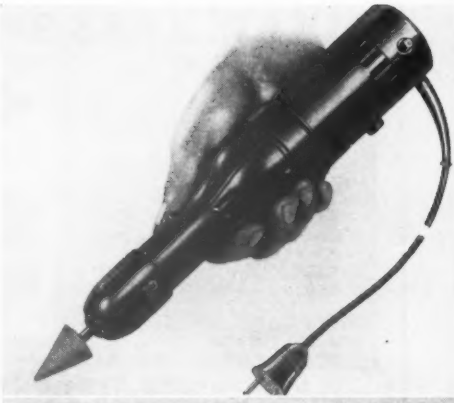
BUILT TO WITHSTAND TRANSVERSAL STRESSES due to milling work, the new Rotoptic High Precision Circular Dividing Table is graduated along its outer edge by 1/6th degrees for positioning with the naked eye. Precise measurements are made on a built-in graduated circle through a tiltable microscope eyepiece. Speed is 4 rpm. Other data may be requested from the COSA CORPORATION, Dept. 2-50, 405 Lexington Ave., New York 17, N. Y., or use INFORM-A-GRAM Key No. 250-U.

EXPEDITING MATERIAL HOLDING OPERATIONS for drilling, reaming, tapping, milling, grinding, injection and ejection, the new line of air cylinders announced by Air-Trol features true-bore cylinders, non-rusting cylinder heads, oilless bronze ram bushings, and precision assembly for smooth, trouble-free operation. Write for detailed material to AIR-TROL, Dept. 38, 2651 W. Lake St., Chicago, Ill., or use INFORM-A-GRAM Key No. K38-U.

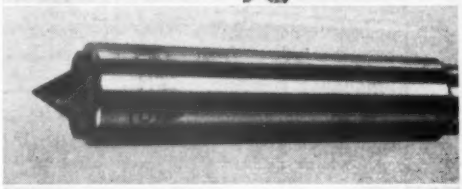
MULTIPLE USES OF RB ABRADING PADS include internal and external finishing, internal grinding, deburring, chamfering, cleaning and polishing of various metals, woods, and plastics. Available in grits of 24 to 320, these abrading pads are made in four standard sizes of 2 to 14 ply of abrasive elements. Questions will be answered on request by the sales distributor, WILKINSON EQUIPMENT CO., Dept. 39, 109 E. 69th St., Chicago 37, Ill., or use INFORM-A-GRAM Key No. K39-U.

ON PARADE

OPERATING AT A SPEED OF 40,000 rpm with a 1/5 hp motor, the new Precise-40 electric hand tool and portable grinder performs usual and special operations on metals, glass, and plastics. Cooled and cleaned by an aerodynamic fan, this new tool also includes a large, rigid quill fitted to hold precision collet chucks. Precise-40 can be used alone as a hand tool or mounted in a stand, vise, lathe, or milling machine. Accessories for special purposes include Coolflex Flexible Shaft Attachment for close work, Drill Stand and Lathe Attachment. Direct inquiries to PRECISE PRODUCTS CO., Dept. 21, 1328 Clark St., Racine, Wis., or use INFORM-A-GRAM Key No. B21-U.



PERFORMING TAPER TURNING OPERATIONS within reasonable limits at very little expense, the recently designed self-aligning center is of special importance to the small machine shop operator. Used in pairs (one in the headstock and one in the tailstock) these centers are easily and quickly set up for taper turning jobs. For complete information write GENERAL ALLIED METALS CO., Dept. TDJ, 220 N. Front St., Burbank, Calif., or use INFORM-A-GRAM Key No. E9-U.

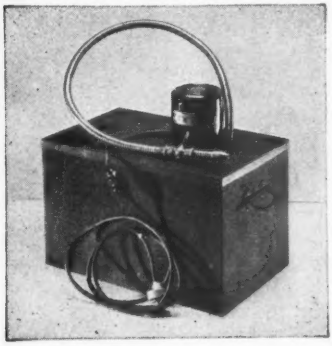


SETTING CUTTING TOOLS ON MACHINES in conjunction with gage blocks and sine bars, the new Micro-Planer Gage offers master setting of measurements in 1000ths of an inch, using regular micrometer graduations; a patented protective lock maintains correct setting. The special thimble top is for body height adjustment. Inquire further from ACCURATE MACHINE PRODUCTS CO., Dept. 28, 1640 S. Hobart St., Los Angeles, Calif., or use INFORM-A-GRAM Key No. A28-U.

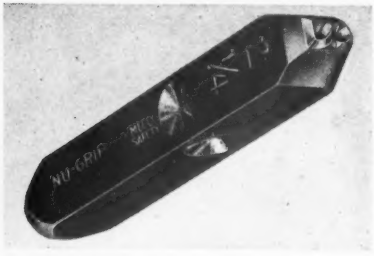
DEPARTING FROM ACCEPTED TILTED MIRROR METHODS of reflected image projection, the new Wilder Surface Illuminator employs a housed ring of eight low voltage bulbs surrounding the projector to give a full uniform illumination over the lens and screen. Also, images in reflected and transmitted light can be produced jointly. Request more information from GEORGE SCHERR CO., Dept. 4-90, 200 Lafayette St., New York 17, N. Y., or use INFORM-A-GRAM Key No. 490-U.

PROGRESS ON PARADE

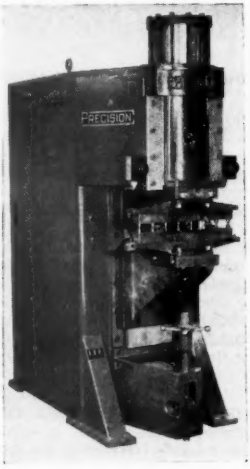
EXCLUDING EXTREMELY FINE METALLIC PARTICLES FROM LIQUID COOLANTS without reducing the flow, the new portable Inject-A-Flow system features a pump operating inside a Strainco Strainer unit. Perfected in cooperation with engineers of machine tool builders, this unit can be adapted to the requirements of any machine tool including grinders. Write INJECT-A-FLOW PUMP CO., Dept. 99, 67 N. Willow St., Montclair, N. J., or use INFORM-A-GRAM Key No. J99-U.



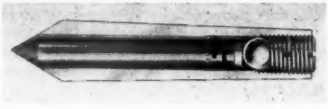
INSURING POSITIVE GRIP, the newly designed "Nu-Grip" safety steel stamp, announced by the M. E. Cunningham Co. features a countersunk hole on each side of the stamp at an exact center point for perfect balance. Available in all standard sizes from 1/32" up through 1", the characters are engraved on heavy duty blanks and suitable for all stamping applications, including marking of tough alloy steel. Request additional data from M. E. CUNNINGHAM CO., Dept. 1-70, 104 E. Carson St., Pittsburgh, Pa., or use INFORM-A-GRAM Key 170-U.



CONSTRUCTED AND STYLED TO DO WELDING JOBS with maximum efficiency and minimum maintenance, the new type AVA, Air Vertical Spot and Projection press-type welders feature unit assemblies, simplified installation and complete accessibility of the interior. Full data may be requested from the PRECISION WELDER AND MACHINE CO., Dept. 32, 138 E. McMicken St., Cincinnati 10, Ohio, or use INFORM-A-GRAM Key No. K32-U.



SIMPLE AND RUGGED IN DESIGN, and no larger than standard solid lathe centers, the new revolving tip "live" centers feature a hardened steel center spindle revolving within a steel taper shank of long bearing surface. Automatically compensating for expansion due to heating of the work, the thrust end of the spindle is slotted and spring tempered. Further literature and information may be requested from E. H. VANDERWALL CO., Dept. 35, 440 Golden Gate Ave., San Francisco, Calif., or use INFORM-A-GRAM Key No. K35-U.



SMALL, COMPACT, AND RIGID, with an exceptionally large boring capacity, the Maxwell Mastur Precision Boring Head is of unique construction with every working part adjustable for wear. The tool block is dovetailed into the body which is split between

A NEW TOOL THAT DOES A HARD JOB

..THE EASY WAY!

PATENT APPLIED FOR

PERSSON DIE JACK

Here, at last, is a new tool designed to separate die sets . . . avoids makeshift prying or hammering methods. Jack is simply clamped on and handle turned to elevate or lower punch holder rapidly or slowly. A precision tool, accurately machined of finest steel and alloys.

NO PRYING • NO HAMMERING
NO DAMAGE • NO INJURY • NO DELAYS

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when you want Speed-
when you want power-

M-5

. . . in your job of sanding, filling and rubbing, drilling or screw-driving, you want a Strand Flexible Shaft machine, because a Strand will do it faster, better, and stand up to it longer.

Strand Flexible Shaft machines provide constant speeds with greater operator convenience. Hundreds of attachments easily interchanged—125 types and sizes—models include vertical and horizontal type machines from ⅛ to 3 h.p. Distributors in all principal cities.

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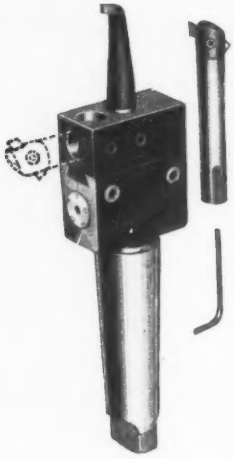
Strand FLEXIBLE SHAFTS

N. A. STRAND & CO.
5003 NO. WOLCOTT AVE. CHICAGO 40, ILL.

the block and the adjusting screw hole so that any degree of tension may be reached. Other date and specifications will be mailed

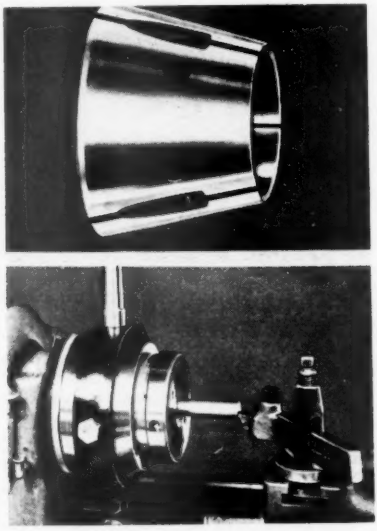


upon request from THE MAXWELL CO., Dept. 42, 225 Broadway, Bedford, Ohio, or use INFORM-A-GRAM Key No. K42-U.

BUILT WITH TWO SEPARATE DRIVING ARRANGEMENTS, a gear drive and a direct belt drive, the LeBlond Dual Drive Lathe has recently been announced by the R. K. LeBlond

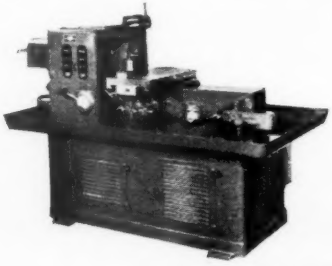
Machine Tool Co. Dual Drive provides 12 spindle speeds, controlled by a single lever, in two separate ranges, eight low and four high for carbide tools. Complete information is available upon request from THE R. K. LeBLOND MACHINE TOOL CO., Dept. 3-59, Cincinnati, Ohio, or use INFORM-A-GRAM Key N. 359-U.

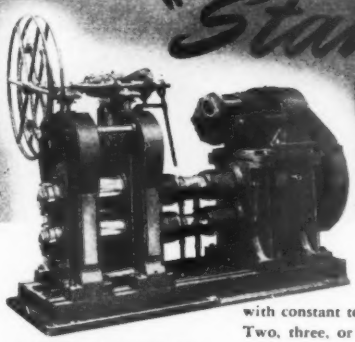
INTRODUCING A NEW PRINCIPLE OF CONSTRUCTION, the Porst Levermatic Collet Chuck insures a positive, straight parallel grip on the work and a steadier hold through the full length of the collet bearing to com-



pensate for work irregularities. Set predetermined pressure and grip corresponding to the weight of the material being machined is assured by a hand-operated selective collet adjustment ring. Additional information may be obtained from PORST BROS., Dept. 61, 259 N. California Ave., Chicago 12, Ill., or use INFORM-A-GRAM Key No. F61-U.

DESIGNED TO MEET PRODUCTION REQUIREMENTS falling between that obtainable on manually operated equipment and full





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ROLLING MILLS

FOR HOT OR COLD ROLLING OF STRIP, ROD AND INGOT

Speeds are provided for rolling metals in any range to 1000 feet per minute and tandem mill stands are designed with constant torque to synchronize stock between stations. Two, three, or four high Mills have roll sizes from 1½" diameter and 1" face to 16½" diameter and 18" face. Special units are also available for grading, cross and pinch rolling, forming wire to exact dimensions and for various shaping operations. Write for Catalog RM.

MANUFACTURERS OF POWER PRESSES TO 500 TONS, ROLLING MILLS, SWAGERS, TURKS HEADS, STEEL DIE SETS.

STANDARD MACHINERY COMPANY

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Just ONE setting per form

Just ONE continuous motion

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• Prominent users tell us they consider "Fluidmotion" Radii and Angle Dressers the finest precision dressing instruments procurable — regardless of cost. They obtain greater accuracy, longer wheel life, and much faster set-up and operation.

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"Fluidmotion"

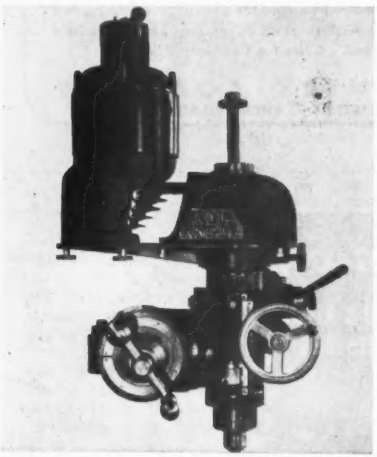
FEATURES:

.0001" accuracy
Automatic Centering
"Fluidmotion" dressing
Dustproof and chatterless
Hardened stainless steel
7" and 14" wheel capacities
Highest quality diamonds

*Reg. U. S. Pat. Off.

automatic or multiple spindle machines, the new Oster No. 650 semi-automatic lathe is now available after thorough operating tests by certain Oster customers. This new lathe is a single spindle machine equipped with a four-speed motor, hydraulic feeds and semi-automatic features. The hydraulically operated cross-slide provides an automatic cycle of fast approach-feed-dwell-fast-retraction-stop. The cross-slide can be converted to manual operation by turning a conveniently placed button. Full details and specifications are available by addressing OSTER MANUFACTURING CO., Dept. 4-18, 2057 East 61st St., Cleveland 3, Ohio, or use INFORM-A-GRAM Key No. 418-U.

SEVERAL IMPORTANT IMPROVEMENTS have been incorporated into four types of Fray "All-Angle" Vertical Milling Attachments. A ¾ hp motor replaces ½ hp on



their type one; additional low speeds on type three with back gearing are 125 rpm and 250 rpm; type four has gained a heavy duty 1½ h.p. motor and a redesigned No. 30 National Standard Taper plus six open belt spindle speeds and two back geared speeds of 125 and 250 rpm. Get specifications and other details from H. LEACH MACHINERY CO., Dept. 8-01, Providence, R. I., or use INFORM-A-GRAM Key No. 801-U.

PUMPING LIQUIDS IN QUANTITIES of 70 gallons per minute, at a total head of 22 feet, is the capacity of the new model 2-C pump just announced by the Ruthman Machinery Company. This pump can be installed either below or above the reservoir in a horizontal or vertical position. When desired, it can be converted to pipe inlet type by use of a pipe adapted plate available in several sizes. Complete details on the "Rumac" pump will

be mailed on request from RUTHMAN MACHINERY CO., Dept. 3-18, 1808 Reading Rd., Cincinnati 2, Ohio, or use INFORM-A-GRAM Key No. 318-U.

DESIGNED FOR TOOL, DIE, general machine and production work on vertical mills, high speed milling heads, screw machines, and drill presses, the new handy, low priced adjustable boring tool, produced by Pump & Products Co., is compact, sturdy, easy to

DRILL JIG BUSHINGS

Accurate
Interchangeable
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CRITERION *Boring Heads*

Original Accuracy *Maintained*

Noted for maintaining original accuracy over a longer period. Criterion Heads are smooth, compact, rigid. Parts subject to wear are hardened. Lead screw is hardened tool steel, with threads ground from solid after hardening. All heads have large, graduated dial. Large offset adjustment eliminates need for offset boring bars. Two sizes: 1½" and 3". ½" and 1" bar capacity. Shanks are interchangeable, enabling operator to use head on different machines. Ideally adapted for slide boring tool holder on small turret lathes. Ask your dealer or order direct. Request free literature.

Write: Attention Dept. C

Lead Screw ground from solid AFTER hardening.

CRITERION MACHINE WORKS
BEVERLY HILLS, CALIFORNIA

adjust and lock. Adjustment for bore diameter is made by means of an Allen screw in the holder and then locked in position by the other Allen screw shown in the illustration. Complete details and specifications are available on request from PUMP & PRODUCTS CO., Tool Division, Dept. 54, 6715 Detroit Avenue, Cleveland 2, Ohio, or use INFORM-A-GRAM Key No. J54-U.

COVERING A WIDER RANGE OF STOCK SIZES AND FEED LENGTHS, two new 6" Dickerman Die Feeds handle coiled strip in any practical combination of thickness up to

3/16" and widths up to 4" and 6" respectively. Maximum feed length for both feeds is 6" on presses having a stroke of 3" or more and approximately double the stroke on others. They are easily and quickly installed on almost any type of punch press to feed from any position. Further information will be sent upon request from H. E. DICKERMAN MFG. CO., Dept. 2-70, 321-TDJ Albany St., Springfield, Mass., or use INFORM-A-GRAM Key No. 270-U.

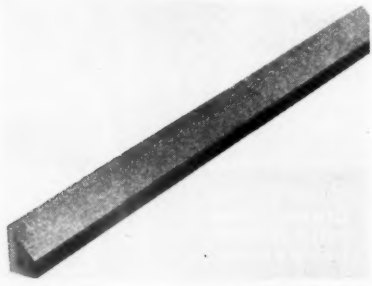
CAPABLE OF MEETING ANY FRACTIONAL HP DRIVE REQUIREMENT, the Men-E-Uses variable Speed Reducing Power Drive has a

range from 20 to 750 rpm with 1725 rpm motors, rotates both to the right and left regardless of the turning direction of the motor, and is adjustable for height. An auxiliary shaft enables it to get down to 4 rpm. Additional information about this versatile drive may be requested from THE FLINCH-BAUGH CO., Dept. 34, 750 South Court St., York, Pa., or use INFORM-A-GRAM Key No. K34-U.

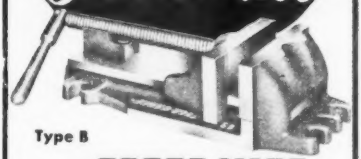
THREE SIZES OF THE NEW WYCO "UNIVERSAL" High Speed Grinder produces grinding efficiency, flexibility and convenience. Set

on a bench, hung from a hook or suspended from operator's belt this compact mobile grinder is made for light, medium and high speed work for grinding, burring, filing, sanding or polishing. Further details are available upon request from WYZENBEEK & STAFF, INC., Dept 5-33, 838 W. Hubbard St., Chicago 22, Ill., or use INFORM-A-GRAM Key No. 533-U.

DESIGNED ESPECIALLY FOR MACHINE BUILDERS, MACHINE REBUILDING OR REPAIR WORK, a recently developed angular straight edge simplifies the task of scraping



SPEED UP with Cardinal



Type B

-SPEED VISE-

Locks and unlocks with a half turn. Opens to its full opening and closes instantly. Rugged—built for production work.

Model 4-AV Automatic

-AIR VISE-

Increases production TEN TIMES or more. Opens and closes automatically. Long-life valves and controls built-in.

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CARDINAL MACHINE COMPANY

Glendale, California

These low-cost

DIAMOND-STUDDED WHEEL DRESSERS

. . . eliminate re-setting time and expense!

A big improvement over single-point stones! When the diamond cutting surfaces wear off, you don't send *this* dresser out for re-setting—instead, a simple ¼ turn in the holder presents a new layer of diamond points—ready to go to work at once! You save the expense of re-setting—you save time, too (the dressers never leave your shop). And you get *uniformly fine dressing* because dresser efficiency doesn't depend on the unpredictable quality of *one* stone, but upon the average of MANY.

Layer upon layer of selected industrial diamonds are anchored in a special Carboloy Cemented Carbide matrix to prevent accidental diamond loss. Particles large and small are held securely throughout dresser's entire useful life.

Available in 3 sizes for rough, semi-finish and finish dressing. Economically-priced. Investigate this money-saving method at once—leaflet SA-127 answers all questions—write for it today.

CARBOLOY COMPANY, INC.

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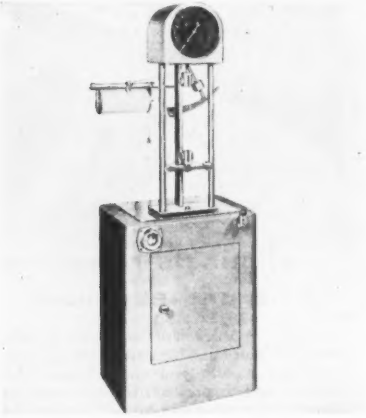
Also Sold By Leading Mill Supply Distributors

CARBOLOY TRADEMARK

WHEEL DRESSERS

and checking of machine ways and slides. It can be used with or without handles at each end. Made of heat-treated Meehanite, with two hand scraped faces, in any size from 18" to 84" in length with any angle specification. Send for further information to MACHINE PRODUCTS CORP., Dept. 1-44, Detroit, Mich., or use INFORM-A-GRAM Key No. 144-U.

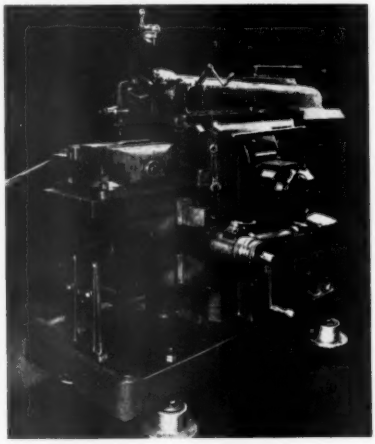
EXPRESSLY BUILT FOR TESTING LIGHTER MATERIALS, the new Dillon "Low Range" Tester shows on its large dial four separate



capacities up to 100 pounds, in ounces and pounds. Variable in its lower grip travel from 0" to 19" per minute, this tester also features max-load reading, stroke limiting switches, forward-reverse switch, elongation gage, stress-strain and numerous other aids. Request data from W. C. DILLON & CO., INC., Dept. 58, 5410 W. Harrison St., Chicago 44, Ill., or use INFORM-A-GRAM Key No. A58-U.

DESIGNED FOR PRESENT DAY APPLICATION OF THE TOOL AND DIE INDUSTRY, Abart Gear & Machine Company, producers of speed reducers, feature type 2⅝ horizontal worm gear drive, having ratios of 5 4/5 to 1 to 100 to 1. Units can be furnished with input or output shafts projecting from either side, or projecting from both sides, and can be mounted in any position. Complete details are available from ABART GEAR & MACHINE CO., Dept. 51, 4827 W. 16th St., Chicago 50, Ill., or use INFORM-A-GRAM Key No. G51-U.

ESPECIALLY HELPFUL IN STOPPING THE TRANSMISSION OF VIBRATION from shapers, and at the same time leveling these machines,



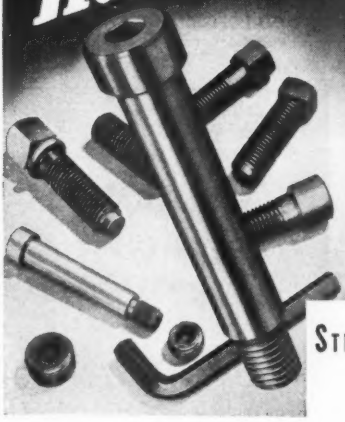
Vibro-Levelers can be attached through the holddown holes in the machine base in only two hours. Even though these mountings are not bolted directly to the floor, there is no creeping due to the "throw" of a shaper. Get additional data from BUSHINGS, INC., Dept. 2-22, 3445 W. 11 Mile Road, Berkley, Mich., or use INFORM-A-GRAM Key No. 222-U.

SPECIFICALLY DESIGNED AND CONSTRUCTED FOR SCREW MACHINE PRACTICE, where operating conditions require sturdy drills, the Stub Screw Machine Drills,

eliminate cutting, thinning, and repointing of regular drills. Made with short flutes and with proper heat treatment, these sturdy Stub Drills can also be used to good advantage in Hand Drills and Breast Drills. Write for complete information to CHICAGO LATROBE TWIST DRILL WORKS, Dept. 5-67, 411 West Ontario St., Chicago 10, Ill., or use INFORM-A-GRAM Key No. 567-U.

ADAPTED TO FIVE-SPINDLE TAPPING, the Pond Operator Model 600, Automatic Control Unit, increases production rates of certain stampings to at least four times as was previously possible on individual hand machines. It is motivated by three forces: Electric—a 1/3

Mac-it ALLOY STEEL SCREWS



Insure smoother operation at POSITIVE levels with STRIPPER BOLTS!

Mac-it Stripper Bolts or Shoulder Screws have greater holding power where you want it in die-assemblies. They are also used as stud bolts and in various machine assemblies. Easily tightened with Mac-it Key. Will not work loose. *All* Mac-it screws are heat-treated and accurately made with die-cut threads. Whatever your needs, let the *complete* Mac-it line serve you. Sold through recognized distributors from coast to coast and in Canada.

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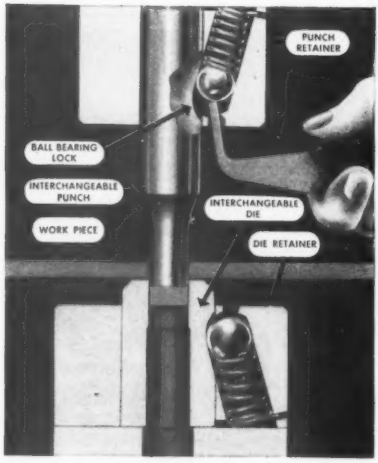
MAC-IT PARTS COMPANY LANCASTER, PA.

PUNCHES and DIES are *Quickly* INTERCHANGEABLE



Allied's R-B Interchangeable Punches and Dies are quickly installed for trouble-free production in the metal-working and plastics industries. They are available from stock in *standard* round, oblong and square shapes of almost any required size. Specials of any size, shape or material are promptly furnished to your specifications — and delivery dates are *dependable.*

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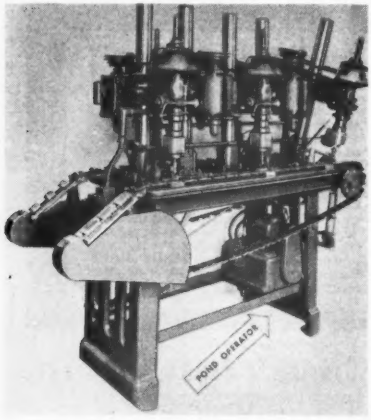
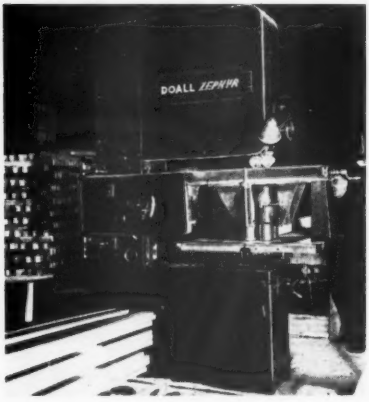
Department 21 ● 4634 Lawton Ave. ● Detroit 8, Michigan

hp motor; mechanical—chiefly a gear-driven, clutch-connected camshaft; and pneumatic—four small air-valves, connected to a com-



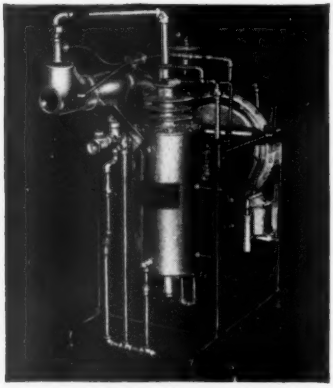
pressed air line. For full details write POND ENGINEERING CO., Dept. 121, 15 Park St., Springfield, Mass., or use INFORM-A-GRAM Key No. G21-U.

HEAVILY CONSTRUCTED FOR POSITIVE FEEDING and vibration dampening, the DoALL's new Resaw attachment quickly con-



verts the Zephyr 36 high speed band saw for resaw and ripping operations. Especially fast in precision sawing of more expensive lumber the versatile unit has a variable speed drive of feed ranging from 0 to 30 feet per minute. For full information, write THE DoALL CO., Dept. 6-96, 1301 Washington Ave., South., Minneapolis 4, Minn., or use INFORM-A-GRAM Key No. 696-U.

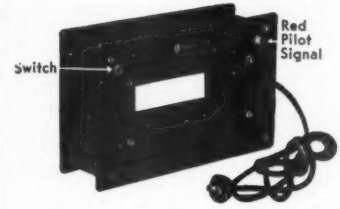
EXCEPTIONAL ADVANTAGES IN THE IMPROVED VAPOFIER, an oil vapor generating unit, provides economical, clean, sootless and



odorless heat, at constant temperatures dependably maintained. A pre-mixer for utility gas, it is also a standby for all industrial gas heat processing operations. Further details as to its use for heating industrial ovens and furnaces and other information may be obtained upon request from VAPOFIER CORP., Dept. 15, 10316 S. Throop St., Chicago 43, Ill., or use INFORM-A-GRAM Key No. K15-U.

MILLED TYPE, STEEP SPIRAL, GROUND FORM MILLING CUTTERS are produced by Motor Tool Mfg. Co. in various irregular shapes, having radii and angles tangent to each other. Arbor or shank type in construction, these new cutters are designed and built to exactly fit the precise requirements of the user. In operation, they cut with a continuous shearing action, teeth being in contact with the work at all times. The great drawback to the use of milled type, steep spiral, ground form milling cutters always has been the inability to keep them in a sharp and serviceable condition. In addition to developing cutters, Motor Tool also has developed a simple and unique fixture for sharpening this type of cutter and keeping its form constant. Full details are available upon request from MOTOR TOOL MFG. CO., Dept. 1-24, 7777 Cortland Ave., Detroit, Mich., or use INFORM-A-GRAM Key No. 124-U.

Save TOOLS · TIME · LABOR
with the Improved · AMC · DEMAGNETIZER



No shop or toolroom can afford to be without one. Thoroughness of the AMC Demagnetizer will give greater precision to finished parts.

One pass through AMC Demagnetizer removes all magnetism from processed parts. Large flat surfaces are demagnetized by sliding unit over surface.

● **Our AMC Demagnetizer will pay for itself in a few weeks. Standard units available, and special sizes to order.**

▶ ***Write today for illustrated circular.*** ◀

ALOFS MFG. CO.
1619 Madison Grand Rapids, Mich.

MILLING - DRILLING - BORING ATTACHMENT *for* Heavy Duty Operations

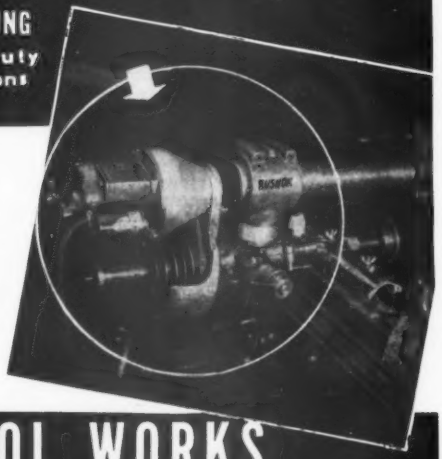


Photo shows a special operation not suited to standard straddle mill set up but easily handled by means of a RUSNOK Milling attachment used horizontally on a standard milling machine, saving one machining operation and accomplishing greater accuracy in finished piece parts. Uses many types of cutters on a wide range of work. Easily mounted—tilts to any angle. Large size spindle (No. 9 B & S taper). Takes ⅛" to ¾" end mills. Large quill with 4" travel, counter balanced, hardened and ground. Six speeds 250 to 3000 RPM. Lever and worm feeds. ½ h.p. motor. Specially engineered by RUSNOK to meet modern demands for high speed, high precision, heavy duty end mill operations. Prompt delivery.

Write for illustrated circular and prices.

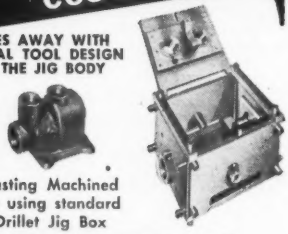
RUSNOK TOOL WORKS
4840 WEST NORTH AVE. CHICAGO 39, ILL.

NEW Drillet

JIG BOX

CUTS DRILL JIG COSTS 75%

DOES AWAY WITH SPECIAL TOOL DESIGN OF THE JIG BODY



Casting Machined by using standard Drillet Jig Box

BUILT IN STANDARD SIZES AND SHAPES UP TO 6" x 6" x 6"
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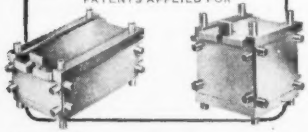

The Drillet Jig Box is a six sided leaf type jig for all phases of drill press operation. Tooling expense can be reduced as much as 75%. All that is necessary is for toolmaker to locate part and insert drill bushings. Eliminates preliminary steps required in building and squaring jig. Side plates, end plates and leaves are replaceable for immediate delivery. Before investing hundreds of dollars in your toolmaker's time —Write for Literature and Prices.

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POLISHING OPERATIONS ARE FACILITATED by the many polishing room accessories manufactured by The Manderscheid Co. Among those described and illustrated in their Bulletin 103 are: work holding spinners, spinner ceiling support, polishing wheel balance ways, tube polishing machines, tube support stand, work supporting roller, and scratch brush lathe. Bulletin 103 is available upon request from THE MANDERSCHEID CO., Dept. 33, 810 Fulton St., Chicago 7, Ill., or use INFORM-A-GRAM Key No. B33-U.

COMPOUNDED INTO A READY MADE POLISHING PASTE that performs effectively in the field of precision manufacturing, diamond powder in uniform suspension has been developed by Sapphire Products Div. of Elgin National Watch Co. Noticeably cutting time and labor costs, diamond polishing paste is available in six grades with several sieve sizes of powder particles. It has been found especially useful in the finishing of steel molds for plastic molding. Literature may be requested from SAPPHIRE PRODUCTS DIV., ELGIN NATIONAL WATCH CO., Dept. 89, Aurora, Ill., or use INFORM-A-GRAM Key No. C89-U.

TO AVOID CONTINUAL REPLACEMENT . . . H.S.S. KNURLING ROLLS which became less accurate after knurling only 12 to 15 pieces, an Eastern aircraft plant has put to use knurling rolls of Carboloy Grade 44A bushing stock that has been ground with a diamond wheel to form knurling serrations of medium pitch. After a year's usage, these knurling rolls are still in excellent condition. Inquire further from DENHAM, Dept. 82, 812 Book Bldg., Detroit 26, Mich., or use INFORM-A-GRAM Key No. 82-U.

FRICTION-LOCKING ENTIRE WORK-LENGTH is made possible with Young Precision Mandrels. Employing an overrunning clutch principle, it insures complete control and gripping of entire bore area, with positive invariable, accurate work-positioning. Self-locking, expanding, and contracting with instant release it eliminates draw-bars, "C" washers and wrenches. Detailed specifications are available from YOUNG ARBOR CO., Dept. 52, 3257 Bradford Rd., Cleveland Heights 18, Ohio, or use INFORM-A-GRAM Key No. B52-U.

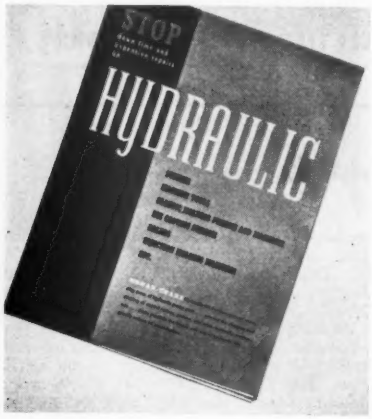
TWELVE-POSITION INDEXING, which permits three different working positions for each tool, gives increased flexibility to the ENCO Cross Slide Turret. One-handed, single action indexing leaves one hand free for simultaneous operations. An easily operated cam lever locks the turret block in place for each operation. Additional data about this versatile turret may be requested from ENCO MANUFACTURING CO., Dept. 30, 4552 W. Fullerton Avenue, Chicago, Ill., or use INFORM-A-GRAM Key No. B30-U.

CREATING AND DUPLICATING SHAPES AND OUTLINES often not obtainable with regular production dies, Di-Acro Benders handle all types of ductile materials such as round, hexagon and square rod, tubing, angle, channel, molding, strip stock and bus bar. These benders induce a minimum of operator fatigue at high hourly production rate. Send for new literature, with detailed operational explanations and illustrations to O'NEIL-IRWIN MFG. CO., Dept. 20, 315 Eighth Avenue, Lake City, Minn., or use INFORM-A-GRAM Key No. 20-U.

FOR PRODUCTION, TOOL ROOM, LABORATORY, production salvage and repair, general jobbing or machine shop use, the Sunnen Precision Honing Machine for sizing Internal Cylindrical Surfaces will produce straight, round holes free from bellmouth, will hone either open or blind holes and produce any degree of surface finish required. A new brochure describing this machine and the Sunnen Coolant Pump, Base Assembly, Weight Hanger Assembly, and Portable Mandrel Drive is available upon request from SUNNEN PRODUCTS CO., Dept. 5-83, 7900 Manchester Avenue, St. Louis 17, Mo., or use INFORM-A-GRAM Key No. 583-U.

GIVING VALUABLE INFORMATION ON MACHINE UPKEEP, a new four-page folder,

issued by the Honan-Crane Corp., tells operators how effective purification of hydraulic oils will remove destructive oil contamination. All types of purifiers available are described



and illustrated with reference to typical installations. For a copy of this folder write to HONAN-CRANE CORP., Dept. 3-22, 208 Indianapolis St., Lebanon, Ind., or use INFORM-A-GRAM Key No. 322-U.

APPLICABLE FOR TOOL-GRINDING, DEBURRING and finishing of small parts, as well as in the woodworking shop, the improved Woods Model "40" Belt Sander and Tool Grinder is ruggedly built. Easily adjusted for either horizontal or vertical operation, it is also provided with simple thumb screw control for belt tracking and tension. Get a full description from catalog sheet 46-1 from WOODS ENGINEERING CO., Dept. 44, Norwalk, Conn., or use INFORM-A-GRAM Key No. K44-U.

HOW PLAIN AND INTRICATE SHAPES ARE PRODUCED from steel plates is described by Joseph T. Ryerson & Son, Inc., in their new illustrated bulletin on flame cutting. Vivid but typical flame cut sections are shown, along with pertinent information on the use of irregular shaped steel plates in both production and maintenance work. Request this bulletin from JOSEPH T. RYERSON & SON, INC., Dept. 4-51, 16th & Rockwell Sts., Chicago, Ill. (or a local branch office), or use INFORM-A-GRAM Key No. 451-U.

DESCRIBING FONDA LIFETIME CARBIDE GAGE BLOCKS and Fonda "Ultra-Finish" Steel Gage Blocks, the recently issued "Precision in Millionths" discusses toughness, expansion, accuracy, stability, wringability and wear resistance. Also, a section gives the complete listing of sizes, number of pieces in sets, prices, and methods of processing and inspection. Request this bulletin, 46-P, from FONDA GAGE CO., Dept. 9-98, Stamford, Conn., or use INFORM-A-GRAM Key No. 998-U.

MEANS OF REDUCING DIE COSTS THROUGH the use of a standard form of retainer and quickly interchangeable punch are reviewed in the Hovis Screwlock Catalog C-4. Giving special attention to the basic design, application, operation, and economies of Hovis retainers, piercing punches and button dies, this catalog contains easily understood explanations, diagrams and charts, plus price lists. Address requests to HOVIS SCREWLOCK CO., Dept. 1-35, 8100 East Nine Mile Road, Van Dyke, Mich., or use INFORM-A-GRAM Key No. 135-U.

ACTUAL PHOTOGRAPHS IN NEAR ACTUAL SIZES of Grobet Swiss files with brief descriptions and available size variations in cut, length, width and thickness are within easy reference in Grobet Swiss Files & Tools catalog. Machine files, rifflers, American pattern files, and other special categories are also reviewed clearly. Write for this 40-page book to GROBET FILE CO. OF AMERICA, Dept. 7-05, 421 Canal St., New York 13, N. Y., or use INFORM-A-GRAM Key No. 705-U.

EIGHT LOGAN LATHES, turret assemblies, collets, chucks, tool posts, barfeed, shaper, and 34 other machine attachments are shown in full illustration, mechanically reviewed and completely interpreted according to setup, operation and performance in the new Logan Engineering catalog now available upon request. Easily read 8 x 11 pages, plus a price list insert, make up a very thorough reference folder. Write LOGAN ENGINEERING CO., Dept. 2, 4901 W. Lawrence Ave., Chicago, Ill., or use INFORM-A-GRAM Key No. 2-U.

SIXTH EDITION OF "Die Sets and Die Makers Supplies", issued by the Detroit Die Set Corp., is now available. The clear layout, including dimensions, set descriptions, die space and prices, on the same page with illustrations and diagrammatic explanations, renders an easily understood description of Detroit Die Sets and Accessories. Get this compact 48-page booklet from DETROIT DIE SET CORP., Dept. 6-74, 2895 W. Grand Blvd., Detroit 2, Mich., or use INFORM-A-GRAM Key No. 674-U.

DISCUSSING HYDRAULICS AS A PRINCIPLE and as applied to production machinery, the new Portman Machine Tool Co. catalog tells the whole story of hydraulics in a simple, accurate way, accompanied by several pages of their equipment featuring advanced designs and accomplishments. This loose-leaf, 20-page booklet is available upon request from PORTMAN MACHINE TOOL

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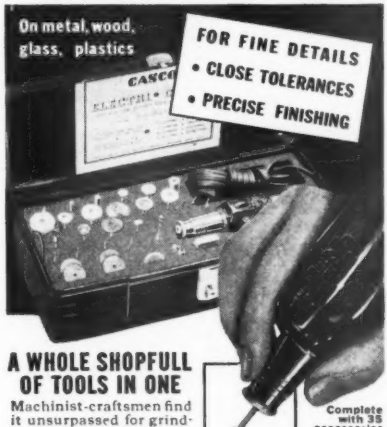

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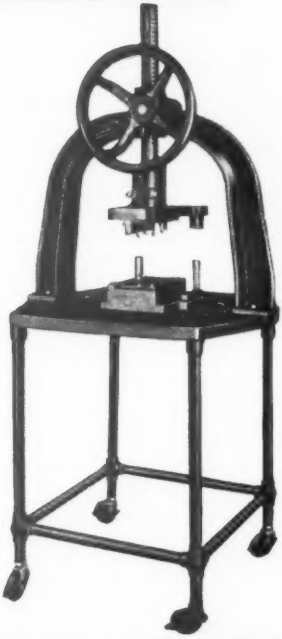

LACEY DIE-SET MACHINE

Here is a truly "one man" press that operates with one hand and under full manual and visual control.

Handy for tool and press rooms, it permits the diemaker to complete a die-set *right at his bench* . . . saves tool room and handling costs.

Positive, true punch-to-die alignment is assured at all times, thanks to the Lacey's sturdy, open construction. And punches can be removed as often as needed without disturbing alignment once the die-shoe is clamped to the table and punch holder fixed in position in the ram. No pry bar or hammer is needed to separate punches.

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CO., Dept. 4-28, New Rochelle, N. Y., or use INFORM-A-GRAM Key No. 428-U.

THREE STYLES OF SINGLE POINTED CARBIDE TIPPED BORING TOOLS, offered by Bokum Tool Co., serve for three purposes, through boring, bottoming and facing, and internal threading. Their unique design, incorporating a helical relief, endows these tools with exceptionally long life. Catalog No. 398, containing information regarding dimensions and price list, is available on request from BOKUM TOOL CO., Dept. 43, 14775 Wildemere Ave., Detroit 21, Mich., or use INFORM-A-GRAM Key No. A43-U.

EXCLUSIVE AND INTERESTING FEATURES of Cincinnati's No. 2 MI Milling Machine are discussed in a recent publication No. M-1506. To further increase the versatility of these machines, built in No. 2 sizes, plain, universal and vertical styles, a wide selection of attachments are available. General specifications and information are given in Bulletin M-1506 available upon request from the CINCINNATI MILLING MACHINE CO., Dept. 2-33, Cincinnati 9, Ohio, or use INFORM-A-GRAM Key No. 233-U.

PRECISION TOOLS, MACHINES, AND INSTRUMENTS produced by the George Scherr Co., are listed in their new 1947 Tool Catalog. Containing 96 pages of valuable information divided into sections on metallurgical equipment, machine tools, measuring instruments, optical equipment, and toolroom specialties, it includes illustrations, specifications, descriptions, and examples of the type of work that can be handled. Request this new catalog from GEORGE SCHERR CO., INC., Dept. 4-90, New York 12, N. Y., or use INFORM-A-GRAM Key No. 490.5-U.

HANDLING A WIDE VARIETY OF PRESSING, STRAIGHTENING, bending, flattening, and assembling operations, the Manco 25-Ton Hydraulic Press is self-contained, easily moved. Of rugged construction, this press operates smoothly and has a high production capacity. Two alloy steel pins adjust the table instantly. Request additional data from MANCO PRODUCTS CO., Dept. 40, York, Pa., or use INFORM-A-GRAM Key No. K40-U.

RECENTLY DEVELOPED USE OF ELECTRONIC type instrumentation to control temperatures for furnaces and melting pots of die casting machines is the main subject of the Wheelco "Comments", Vol. 6, No. 2. Discussing the physical properties and specific applications of the variety of casting alloys now in use, the article emphasizes many points with photographs. This publication may be requested from WHEELCO INSTRUMENTS CO., Dept. 72, Harrison & Peoria Sts., Chicago 7, Ill., or use INFORM-A-GRAM Key No. 72-U.

ELIMINATING TIME LOST THROUGH CUTTING, SHAPING, planing, and finish grinding of tool steel, Marshall Steel is the new ready-to-use carbon tool steel. Its chemical and physical properties are fully controlled and held to the highest standards. Annealed, heat treated, and precision ground, Marshall Steel is well suited for templates, dies, jigs and gages. Write for other information to MARSHALL STEEL, Dept. 41, 228 N. LaSalle St., Chicago 1, Ill., or use INFORM-A-GRAM Key No. K41-U.

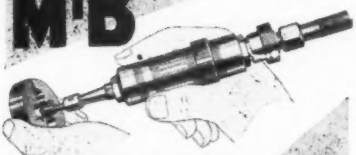
A FAST, ACCURATE UNIT APPLICABLE FOR DRILLING, reaming, tapping, and boring operations, the Robbins Index Table assures effortless positive indexing. Operated manually, but located automatically, this index table can never be rotated in the wrong direction. It is also protected against unnecessary friction and out-of-parallel condition. Further information is available from ROBBINS ENGINEERING CO., Dept. 6-17, 318 Midland Ave., Detroit 3, Mich., or use INFORM-A-GRAM Key No. 617-U.

LUFKIN PRECISION TOOLS, cataloged by The Lufkin Rule Co., include micrometers, calipers, dividers, combination and other squares, center, depth, planer, radius, screw pitch, telescoping, thickness and other gages, steel scales, and related items. Built to maintain their reputation, these tools are all of the highest grade and embrace many exclusive features. Catalog No. 7 giving illustrations, descriptions, etc., is available upon request from THE LUFKIN RULE CO., PRECISION TOOL DIV., Dept. 6-09, Saginaw, Mich., or use INFORM-A-GRAM Key No. 609-U.

"DUSTKOPS STOP DUST AND LINT FROM POLISHING AND BUFFING" is Aget-Detroit Company's new bulletin containing illustrations of typical installations of Dustkop dust collectors, dimensions and prices of the Model 1150 unit, in addition to heat saving possibilities with the recirculating type collectors. Gathering dust, lint and rouge from polishing, buffing and metal coloring operations can economically be accomplished by individual units, one for each polishing lathe, avoiding wasted power. Complete information is available from AGET-DETROIT CO., Dept. 5-77, 602 First National Bldg., Ann Arbor, Mich., or use INFORM-A-GRAM Key No. 577-U.

FLEXIBILITY IN SPECIAL MACHINE DESIGN of Ex-Cell-O Hydraulic Power units is presented in an illustrated 16-page bulletin No. 45361, which includes engineering information, installation drawings and application photos of the three sizes of the "package unit" for feeding and rotating cutting tools. General information is given on the use of these units in building economical special-purpose production machines. Write EX-CELL-O CORP., Dept. 7-37, Detroit 6, Mich., or use INFORM-A-GRAM Key No. 737-U.

M·B MODEL SS-SR



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The only hand grinder with spindle speed of 100,000 R.P.M. on 100 pounds air preasure. It has revolutionized hand grinder performance. Can be directed in any working position; operates with extreme ease. Steel construction throughout. Formed to fit the hand. Weighs only 14 ounces. Prompt delivery.

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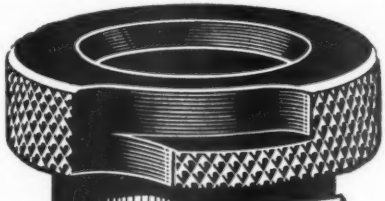

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USE WORLD'S FASTEST VISE

CUT COSTS UP TO 75%
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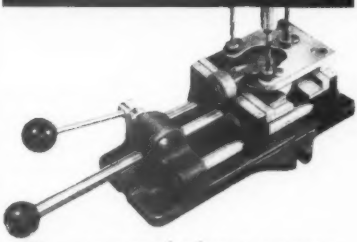

You can stop the heavy expense and time losses common in the building of special jigs for drilling and light milling operations. Use the Heinrich "Grip-Master" as a base-structure. Built-in bosses and removable parallels permit easy attachment of bushing plates and locating jaws. You can speed up loading and unloading unbelievably, thanks to the large jaw openings of the "Grip-Master" and its revolutionary *screwless* feature.

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Ask your Mill Supply Dealer about the Heinrich "Grip-Master." If he does not yet have a stock, write for folder that fully illustrates and describes the money saving uses of this amazing tool.

HEINRICH
Grip-Master
DRILL PRESS TYPE
SCREWLESS VISE

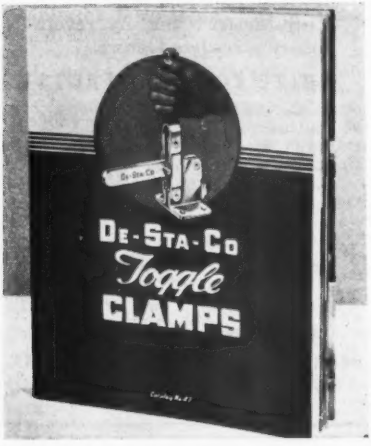
NATIONAL MACHINE TOOL CO.
DEPT. 137-D, RACINE, WISCONSIN

CARBIDE TIPPED CUTTERS, especially designed for milling cast iron, have been developed by Super Tool Co., in plain, side, half-side, shell and face mill forms. Full descriptive literature is available including information on standard inserted blade cutters with solid carbide blades, for most effective high speed milling. Write to SUPER TOOL COMPANY, Dept. 1-68, 21650 Hoover Ave., Detroit 13, Mich., or use INFORM-A-GRAM Key No. 168-U.

PRACTICALLY EVERY SOLDERING NEED IS MET with the Hexacon Hatched type iron. It has better balance, resulting in less operator fatigue, low maintenance, replaceable elements and faster soldering in inaccessible places. Other advantages are listed in a bulletin available from HEXAGON ELECTRIC CO., Dept. 3, "125" West Clay Ave., Roselle Park, N. J., or use INFORM-A-GRAM Key No. K3-U.

RUGGED AND BUILT FOR LONG LIFE. Master Portable Flexible Drive Grinding Machines and Tools can be employed profitably by all industries even for occasional uses. Grinding machines can be equipped with any hand tool required and additional hand tools can be furnished as the need arises. Bulletin IED 683 is available on request from the MASTER ELECTRIC CO., Dept. 83, Dayton 1, Ohio, or use INFORM-A-GRAM Key No. D83-U.

PROBLEMS INCLUDING THE HOLDING OF PARTS in production are answered in the 32-page 1947 De-Sta-Co Toggle Clamps catalog that was recently issued by the Detroit Stamping Company. Containing detailed specifications, illustrations, and applications of their clamp line, this catalog also devotes a full section to arbor spacers, shims, shim and feeler stock and several job stampings. Write for Catalog 47 to the DETROIT STAMPING CO., Dept. K, 344 Midland Avenue, Detroit 3, Mich., or use INFORM-A-GRAM Key No. 165-U.



BRIEFS FROM INDUSTRY ON THE LATEST DEVELOPMENTS and applications of Metallizing (metal spraying process) are discussed and illustrated in a quarterly issue of Metco News. A technical article describes Metcolizing (a special metallizing process) as a means of controlling grain growth in plain cast iron, subject to high temperatures. Detailed information is available from the METALLIZING ENGINEERING CO., INC., Dept. 3-90, Long Island City, N. Y., or use INFORM-A-GRAM Key No. 390-U.

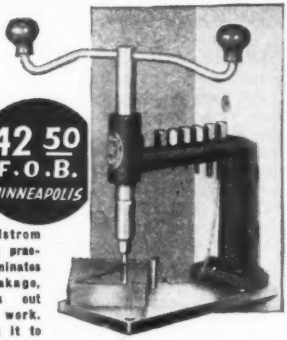
SIMPLY AND CONVENIENTLY CONTROLLING COMPRESSED AIR, Lehigh Marton short-stroke piston action foot and hand operated valves are designed to permit the placement of supply and outlet openings at any position. Small and compact with no dust-catching crevices, these control valves are easily installed and maintained. Instructive literature including photographs and diagrammatic explanations are available upon request from LEHIGH FOUNDRIES, INC., Dept. 18, 1500 Lehigh Dr., Easton, Pa., or use INFORM-A-GRAM Key No. K18-U.

ACCURACY OF STANDARD AND SPECIAL GAGES of Merz Exactitude Products is described in literature recently issued. A. G. D. Plain Cylinder Gages, plain plug and ring gages, straight and tapered; A. G. D. Standard Thread Gages, plug gages, ring gages and thread ring setting plugs; National Pipe Thread Gages and Special Thread Gages are illustrated. Write for further details to MERZ ENGINEERING CO., Dept. 7-20, Indianapolis 7, Indiana, or use INFORM-A-GRAM Key No. 720-U.

SPEEDING MATERIAL HANDLING ON ANY JOB is profitably achieved with Master Hoists. The Speedmaster, electrically controlled, is designed for fast, heavy or medium duty, has all anti-friction bearings, and requires small head room. The Cablemaster, manually controlled for safe, economical medium duty has a high grade cable that does not require special fittings, ideal for lifting heavy parts into machine tools. Other features are listed in a four-page pamphlet which is available upon request from THE MASTER ELECTRIC CO., Dept. 83, Dayton 1, Ohio, or use INFORM-A-GRAM Key No. D83-U.

ELIMINATING ALL SPINDLE BACKLASH the Ellis Dividing Head provides positive adjustment between its precision ground worm and worm gear. Equipped with an auxiliary swiveling base and a direct indexing attachment, this unit quickly increases the versa-

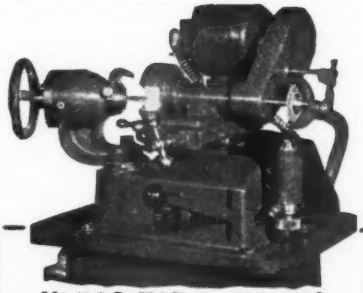
Square, Straight Tapping in HALF THE TIME



42 50 F.O.B. MINNEAPOLIS

The Dahlstrom Tap Guide practically eliminates tap breakage, and turns out uniform work. Just fasten it to a post or bench, slip a Tap Adaptor into the spindle, and turn the handle. Equipped with 7 Adaptors from 8/32 to ½" (taps not furnished). Ask your mill supply house, or order direct. Literature on request. Dahlstrom Mfg. Co., 422 South Sixth St., Minneapolis 15, Minn.

Dahlstrom TAP GUIDE



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tility of millers, grinders, drill presses, or jig borers. Write for illustrated literature to NICHOLS-MORRIS CORP., Dept. 9-43, 50 Church St., New York 7, N. Y., or use INFORM-A-GRAM Key No. 943-U.

ACTING AS A "SHOCK ABSORBER" for the cutting edge, the special copper cushion of the 12% Cobalt H. S. S. Tool Bit, perfected by GENERAL TOOL & DIE CO., permits the use of 65 to 68 Rockwell "C" Hard Bits and offers up to 500% greater tool life between grinds on a variety of work. Additional information may be requested from the manufacturer, Dept. 36, 555 Prospect St., East Orange, N. J., or use INFORM-A-GRAM Key No. G36-U.

ESPECIALLY ADAPTED TO THE CUTTING OF LONG, HEAVY STOCK on the Johnson Metal Cutting Band Saw, the Johnson stock stand equally well meets similar needs with any machine tool. Non-breakable, portable, and instantly adjustable to any working height, the stock stands are all-steel, yet light weight. Write for further details to JOHNSON MFG. CORP., Dept. 55, Albion, Mich., or use INFORM-A-GRAM Key No. G55-U.

RADICALLY REDESIGNED TO CUT 3 TIMES FASTER, the Elox disintegrator head will now penetrate hardened steel 3/32" per minute. The tubular copper electrode while emitting water cuts a core through the center of an imbedded broken tool, thus permitting the removal of tool pieces without damaging the part. Three types of Elox power generators are made or this equipment: bench model with outside water connection, bench model containing coolant system, and heavy duty model with recirculating coolant system. Get full details from ELOX CORP., Dept. 9-07, 602 N. Rochester Rd., Clawson, Mich., or use INFORM-A-GRAM Key No. 907-U.

INTRODUCING A NEW LINE of combination circular cutoff and chamfering tools for use on Brown & Sharpe Automatic Screw Machines, the folder recently published by the Weldon Tool Co. lists tools which will accomplish chamfering to practically any desired diameter. Filling a definite need, these Weldon high-speed circular cutoff tools are designed to offer an option in connection with cutoff angles of 15° for steel and 23° for brass. Request this new list and descriptions from WELDON TOOL CO., Dept. 5-17, 3000 Woodhill Road, Cleveland 4, Ohio, or use INFORM-A-GRAM Key No. 517-U.

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SPRINGFIELD PRECISION GEARED HEAD LATHES are clearly described in new literature featuring actual photographs of the headstock, apron, compound rest, taper attachment, carriage and draw-in collet attachment which accompany data on mechanical operation and production ranges. A complete 41-item parts breakdown is also included in this very informative folder which may be requested from THE SPRINGFIELD MACHINE TOOL CO., Dept. 6-47, Springfield, Ohio, or use INFORM-A-GRAM Key No. 647-U.

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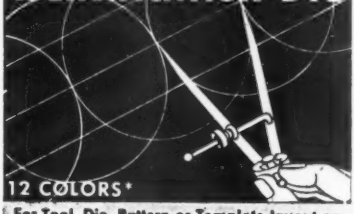

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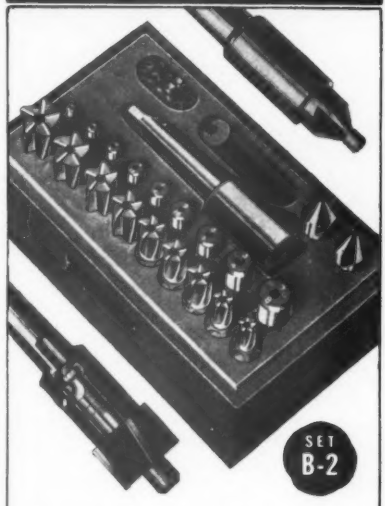

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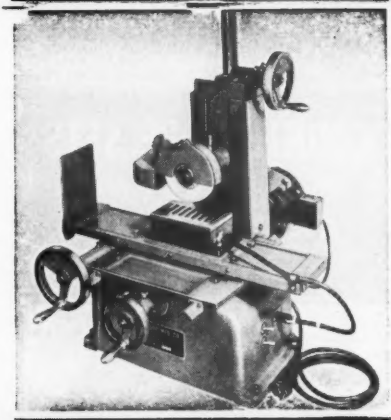

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WHIPPING TROUBLESOME LUBRICATION PROBLEMS are dismussed in Volume 2, No. 3 of "Clean Oil", a pictorial publication devoted to oil purification, issued by Honan-Crane Corporation. Case histories of oil purification equipment are analyzed, covering specific applications on hydraulic equipment used in the manufacture of plastics, metal products, drop forgings, grinding wheels and abrasives, as well as on transformer oil in electric light and power plants. Illustrated with pictures and engineering diagrams, copies are available upon request from Honan-Crane Corp., Dept. 3-22, 208 Indianapolis Ave., Lebanon, Ind., or use INFORM-A-GRAM Key No. 322.5-U.

WEAR RESISTING TOOLS, DIES, AND PARTS made from "Malta" "T and V" cast-to-shape chromium-tungsten-cobalt-boron alloy, that effectively bridges the gap between high speed and cemented carbide cutting tools, are illustrated and described in an new 24-page catalog just published by the Jessop

Steel Co. Specifications are given for standard "Malta" carbide tool tips, tools, and wire drawing dies and for "T and V" cast alloy tool bits. Requests for this new catalog should be made on company letterhead addressed to Jessop Steel Co., Dept. 2-59, Washington, Pa., or use INFORM-A-GRAM Key No. 259-U.

REVISED "BLUE SHEETS", containing new information about 7 alloy steels and the Methods Manual for "Carmet" Carbide Metal Tools, have been published recently by the Allegheny Ludlum Steel Corp. The physical properties and characteristics of die steels are discussed briefly but clearly in the "Blue Sheets" now in their 11th edition. The Carmet Manual, 2nd edit., contains a list of Carmet grades and recommendations for their usage, describes grinding and brazing, and offers many other ideas on the most effective utilization of this steel. Write for this helpful literature to Allegheny Ludlum Steel Corp., Dept. 6-78, Pittsburgh, Pa., or use INFORM-A-GRAM Key No. 678-U.

"MANUAL FOR HEAT TREATING SERVICES", new loose-leaf type book devoting sections to various machining jobs on steel, basic and advanced principles of heat treating, and a glossary of metallurgical terms is designed to inform manufacturers of the range of heat treating services which would enable them to easily identify and specify their needs. Compiled and published by the Metal Treating Institute, New York 17, N. Y., the "Manual for Heat Treating Services" is priced at $4.00.

"NOTES ON STRESSES IN HELICAL SPRINGS" is presented as a 6-page article in the December issue of Mainspring, published by the Associated Spring Corp. Punctuating the detailed discussion with charts covering deflection and stress reactions, formulae, and factual-humorous cartoons, the article gives a clear textbook-like review of this subject. The ordinary helical compression spring may seem to be a relatively simple affair, but when viewed from the standpoint of the stress-analyst or the elastician, such a spring represents a most complicated study in stress distribution. Copies may be requested from the Associated Spring Corp., Dept. 43, Bristol, Conn., or use INFORM-A-GRAM Key No. K43-U.

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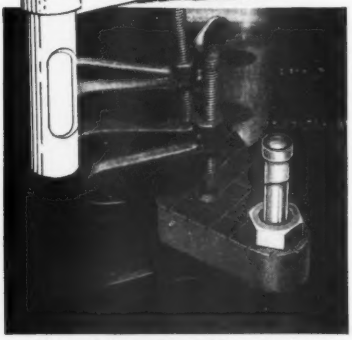

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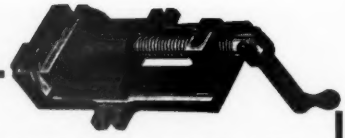

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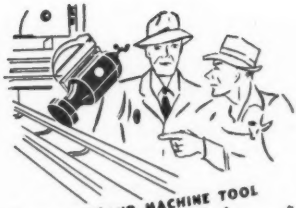

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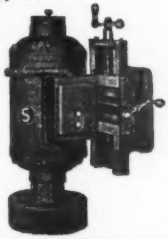

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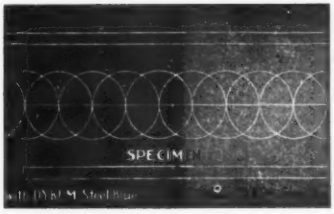

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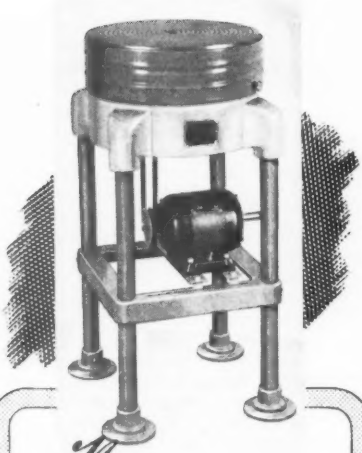

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(CONTINUED FROM PAGE 96)

side of the machine. It is suggested that the same idea could be used in the case of hydraulic valves and other controls. They should not, however, be a part of the electrical control enclosure. By use of this construction, control can be removed without disturbing the piping and trouble is easily located. The panel should be mounted preferably on the machine, but if a separate unit it should be placed as close as possible to the machine in order to keep the amount of exposed piping to a minimum.

3. Pipe units should be designed so that they can be easily removed as one assembly, and all joints should be located so that in case of leakage the oil will drain to a sump rather than on the floor or on the machine.
4. Oil reservoirs should be located at a point high enough in the machine so that they can be drained easily and flushed clean. Pumping and wiping is not an efficient method of cleaning an oil reservoir.
5. Accessibility does not necessarily mean placing all the piping, valves, etc., outside of the machine. They may still be placed inside the machine but with convenient lightweight covers provided so the repairs and replacement can be made easily.

Oil Leakage

Another unanimous complaint among our plants is oil leakage. This leakage results not only in high maintenance costs and poor housekeeping but also allows air to enter the system, resulting in uneven rates of feed. This condition results in excessive tool cost since most of the modern cutting tools depend on an accurate constant feed for their high rate of production.

This leakage occurs at pipe joints, feed cylinder glands and at the drive shaft seal in the pump. The use of manifolds and valve panels will reduce the number of pipe joints and thereby reduce the potential points of leakage. In many cases the better support of pipes and the use of vibration eliminating supports would do away with the joints loosening up and the actual fracturing of pipes and tubes.

We all realize that the elimination of leaks is a problem but everything possible should be done to prevent them.

Hydraulic Circuit Diagrams

The third most common complaint is that very few machine tool builders furnish a diagram of the circuit used. Almost all the people contacted mentioned this. One of our plant engineers stated that he thought the manufacturers considered their circuits a secret.

I believe that accurate schematic diagrams giving all the information necessary for servicing an installation would materially reduce the time required to maintain hydraulic machines. The plant engineer of one of our largest plants had the following suggestion:

"All manufacturers of hydraulically operated machines should provide the user with accurate, colored schematic circuit diagrams. There should be a schematic diagram for each phase of the machine cycle: clamp, rapid traverse, rapid reverse, etc." In the opinion of this plant engineer the lack of schematic diagrams is the chief cause of excessive periods of down-time for hydraulic trouble shooting which in turn results in excessive loss of production. "There should be a standard color code adopted and used by all manufacturers of hydraulic equipment.

Red—Pressure
Yellow—Suction or Drain Oil
Blue—Charge or Back Pressure Oil
Green—Trapped or Stagnant Oil
Brown—Metered Oil

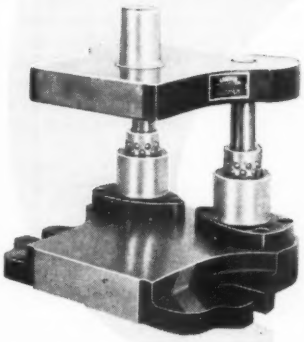
This code indicates the action of the oil in the circuit regardless of its pressure."

Identification and Terminology of Replacement Parts

Another plant engineer suggested that the circuit diagrams should specify the model and type or size of parts so that replacement or stock parts could be ordered from the diagram rather than wait until something goes wrong and then remove the part before being able to order a new one.

★ ★ ★ ★ ★ ★

SAVE UP TO 60% OF DIE SETTER'S TIME WITH LEMPCO ANTI-FRICTION DIE SETS



On one die, Atlantic Tool and Die Company saved 40 hours of assembly and set up time, by using Lempco Anti-Friction Die Sets.

Lempco Anti-Friction Die Sets are equipped with ball or roller bearing guide pins. That's why dies can be set up by hand without the use of hammers, mauls, jacks or pry bars. This eliminates production delays caused by accidents to die and punches—saves up to 60% of die setter's time. Lempco Anti-Friction Die Sets positively eliminate all down-time caused by bound, scored or galled guide pins.

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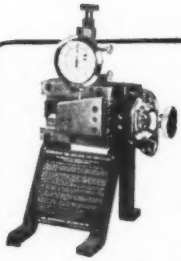
In connection with schematic diagrams it is necessary that immediate steps be taken to establish and use uniform schematic symbols and also uniform terminology for hydraulic accessories. This lack of uniformity at the present time is the cause of a great deal of confusion on the part of machine tool designers and maintenance personnel.

Inaccessibility, oil leakage and lack of information are apparently the causes of most of the dissatisfaction among our people. They all have a direct bearing on maintenance costs and loss of production, and every effort should be made to remedy these conditions as soon as possible.

Further Mechanical Refinements

In addition to the three problems I have mentioned there were several other criticisms and suggestions, the more important of which I would like to call to your attention. While these points were not brought up by all of our plants, a large majority brought them up in our discussions.

1. Oil reservoirs are too small, resulting in overheating the oil which causes improper functioning of valves and distortion of the machines themselves. In order to overcome this difficulty some machine tool builders install refrigerating units or other means for cooling the oil, all of which further complicate an already complicated machine, and none are entirely satisfactory. In many cases it has been necessary to install auxiliary reservoirs on machines in our plants and this at its best is a makeshift arrangement.
2. I find that straight hydraulic clamping has been the cause of many accidents due to the failure of the hydraulic system. We recently wrecked an expensive machine and its tooling due to the breaking of one of the pipes to the clamping mechanism. Hydraulic pressure should never be used for clamping without an intermediate mechanical device such as a cam or toggle which will remain locked if the oil pressure should fail.
3. In large, process-type machines using many heads or working stations most of our Divisions prefer an individual self-contained hydraulic unit for each head. Any other construction results in pipes strung around a machine and not only confuses the maintenance people but multiplies trouble with leaks and adjustments. In many cases a machine with individual units can be operated while one station is being repaired; but in the case of a central pump supplying many stations the entire machine must be shut down.
4. The use of fluid motors in combination with screw or other types of mechanical feeds should be given more consideration. This design gives the advantages of the flexibility of hydraulics and in addition eliminates much piping and many valves.
5. Many manufacturers of machine tools do not give enough attention to the lubrication of table and slide ways. If possible, this is more important than on mechanical feed machines since poor lubrication at these points results in high pressures which in turn cause heat, leakage, and erratic performance.
6. We have had considerable difficulty with solenoid valves due to wearing of the elaborate linkages. In many designs very slight wear will result in valve operation failures.
7. Many valve bodies are so designed that the mounting bolts when tightened distort these parts. Also, pipe and tube connections distort valve bodies when the oil temperature rises, resulting in binding of valve spools.
8. We have had some cases where feed cylinders are not securely fastened to the machine frame, allowing them to move. This condition results in excessive piston rod packing wear, leakage at pipe joints and vibration.
9. The last item I have is very important from our point of view and that is a standardization program covering the various pumps, valves,



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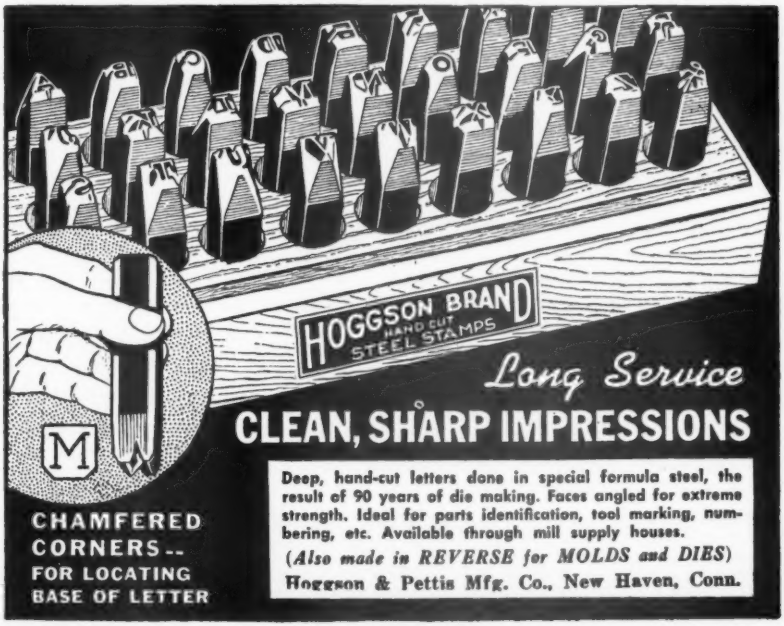

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switches, etc., used in hydraulic equipment. With the many different makes being used by the machine tool builders it is imperative that mounting dimensions be standardized. It is now necessary for us to stock hundreds of such items simply because mounting dimensions vary.

In closing I would like to again emphasize the fact that these comments have been those of many people in our Divisions. I hope that every effort will be made to remedy the conditions mentioned as soon as possible. Also, I believe that there are many advantages to an arrangement similar to that now in effect between the electrical equipment manufacturers, the machine tool builders and the machine tool users. This joint group has accomplished a great deal in the last two years and I believe that such an arrangement with the manufacturers of hydraulic equipment could clear up much of the misunderstanding regarding hydraulic equipment which now exists.

We in General Motors definitely agree that there is a great need for hydraulically operated equipment but we also feel that we should make known our difficulties with present hydraulic equipment. There should be more done on the part of the hydraulic equipment manufacturer than furnishing a list of parts to the machine tool builder. He should cooperate in the design of machines and make certain that his equipment is installed in such a manner that it is satisfactory to the purchaser of the complete machine. Dissatisfaction on the part of purchasers reflects on the manufacturer of hydraulics used and also on hydraulics as a whole.

As for the argument regarding advantages and disadvantages of various methods of operating and controlling machine tools we have four choices:

1 Electrical

2 Hydraulic

3 Mechanical

4 Combinations of the three.

We have them all today and they will continue to be used where each fits best. Improvements are constantly being made in all methods.

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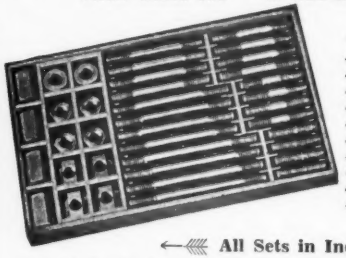

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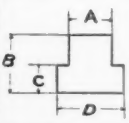

Holes & Thread	A	B	C	D
½"—13 THD.	.555	¾"	11/32"	⅞"
⅝"—11 THD.	.675	1⅛"	15/32"	1⅛"
¾"—10 THD.	.800	1⅜"	⅝"	1⅜"

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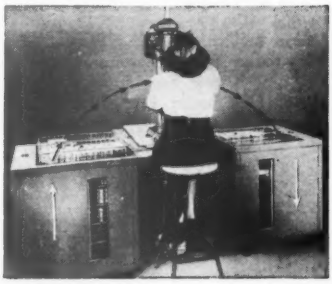

This three-in-one unit, now being manufactured by American Machine & Foundry Company, automatically brings material to operator's working level. It may also be used for progressive assembly, storage and transporting materials.

As shown in the picture, the operator takes the material from the tray on the left and places the processed pieces on the tray at the right. When the tray on the left is emptied, a calibrated spring mechanism raises the next tray to working level. The tray on the right automatically depresses into the rack when filled. The filled rack can then be easily rolled away and used as a storage unit. Production is speeded up since the same working level is constantly maintained, and the flow of material is timed to the worker's capacity.

Reloading is accomplished by simply placing the material on the platform where it automatically finds its proper level. The units are designed to handle any weight, and load changes are made by merely unhooking one end of the springs. The use of these racks does away with the psychological slow down, physical back strain, and eliminates the accident factors involved in manual lifting.

The Lowerator Division of American Machine & Foundry Company, Dept. DJ, 511 Fifth Avenue, New York 17, N. Y., will send complete specifications, or use INFORM-A-GRAM Key No. F33-U.

East Shore Announces

purchase of manufacturing and sales rights of the State Boring and Reaming Tool and allied products. These tools are now being produced in the East Shore Factory, well known for years of manufacture of precision automotive parts, the Glenny Broach, etc.

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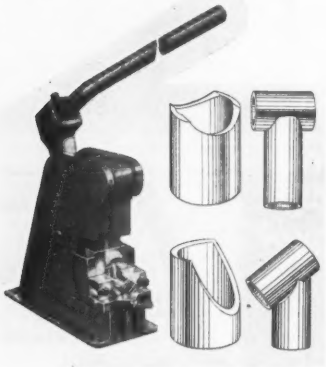
Vogel Tool Works has developed the Arc-Fit die for shearing pipe and tube ends which will weld into any pipe or tube assembly. The design of the die permits its use either with an Arc-Fit hand press or in any power punch press. Pipe sizes up to 2 inches are easily handled in the hand press, while sizes above 2 inches are formed in a punch press.



In operation, the tube or pipe end is placed over the head of the male die or punch so that the punch is within the pipe. Pressure is then applied downwardly on the punch holder and the punch, in conjunction with the cutting edge of the die part, shears off one lip of the pipe. The pipe is then rotated 180° and the opposite side is notched out, thereby forming a contour shape on the end of the pipe which will fit the O D of pipe of similar diameter. No other operation is necessary. Punch and dies to accommodate different sizes of pipe are available. For complete details write Vogel Tool and Die Corp., Dept. 46, 2527 Moffat St., Chicago 47, Ill., or use INFORM-A-GRAM Key No. K46-U.

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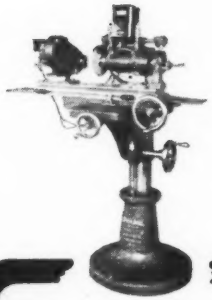

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Height of Table from Base—2 1/16".
Standard 12-position Table.
All working parts hardened.

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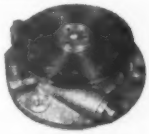

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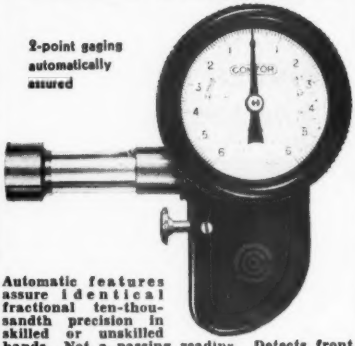

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(CONTINUED FROM PAGE 83)

(f) Is plant kept clean?

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(i) Are working hours and rest periods appropriate?

(j) Would music help?

(k) Is manner of job assignment sufficient? Are tools, gages, drawings supplied to operators or must they obtain them?

Workplace Layout and Motions

The methods for cutting costs described herein are well within the scope of the average small or medium manufacturer. In practice they have been sufficiently productive of manufacturing economies in varied industries to warrant their general application. The intelligent employment of these methods can materially help management in the impending all-out battle for markets.

This subject is sufficiently broad and of sufficient importance to warrant extended discussion. For this reason it will be left for a subsequent article in which it will receive its due attention.

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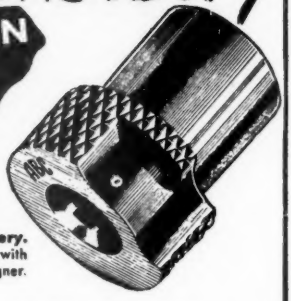

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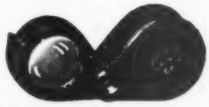

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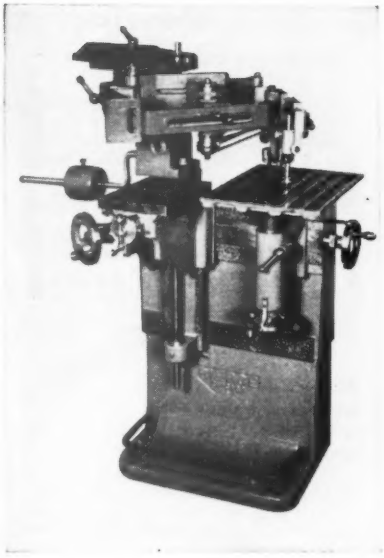

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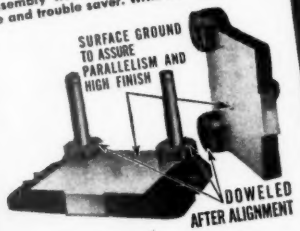

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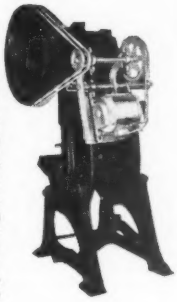

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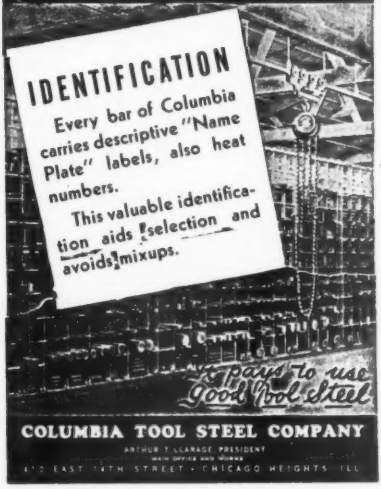
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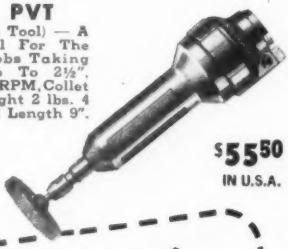

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(CONTINUED FROM PAGE 90)

enters the port opening ahead of the cutters, thereby holding the two cutter blades in a true position to insure that the finished piece will meet the required concentricity.

The cycle for machining the outlet port, C, Figure 16 and 21, is: (1) load, tighten chuck, index; (2) drill 25/64" hole, 1½" deep, IV-N, Figure 16, face end of port IV-O, and rough turn seat, IV-P, index; (3) drill 25/64" hole, 2 $\frac{5}{16}$" deep, IV-N, finish turn excess stock, from outer surface of boss, IV-Q, continue rough turning seat, IV-P, index; (4) finish facing IV-O, finish turning seat, IV-P, chamfer for first thread, IV-R, index; (5) cut external threads, IV-S, index; (6) unload and load.

This same cycle is repeated for machining the other outlet port V-A. Because the position of the valve body in the chuck for this operation will be different from that of the preceding one, another set of correspondingly designed pads is used.

All machining is carefully gaged with plug, snap thread ring and roll thread gages. A unique gage has been developed by Parker engineers for gaging the concentricity of the seat and threads with the axis of the outlet port.

These three sets of operations can be run on one machine or on three machines. If they are to be run on one machine, all the bodies on the shop order will be run through on the valve port machining operation. A new tooling setup will then be made to perform the machining on one of the outlet ports, and the run made.

(TO BE CONTINUED)

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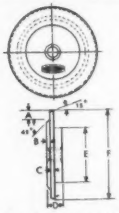

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00-50	00	3/16	.0975	1/16	.050	1/4	1 19/64	1.750	4.00
00-60	00	1/4	.131	1/16	.060	1/4	1 19/64	1.750	4.00
00-80	00	5/8	.1985	1/16	.080	1/4	1 15/16	1.750	4.00
0-60	0	5/8	.1935	3/32	.060	5/16	1 5/8	2.250	4.50
0-80	0	1/2	.261	3/32	.080	5/16	1 5/8	2.250	4.50
0-90	0	5/8	.3265	3/32	.090	5/16	1 5/8	2.250	4.50
2-60	2	5/8	.1935	1/8	.060	3/8	2 7/32	3.000	5.60
2-90	2	5/8	.3265	1/8	.090	3/8	2 7/32	3.000	5.60
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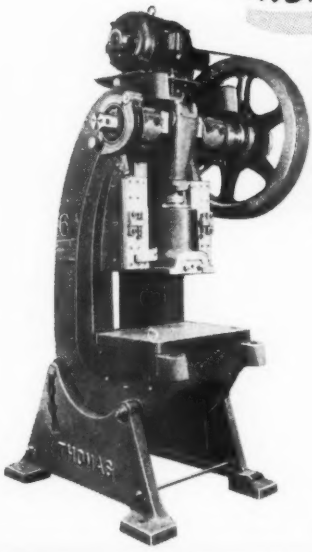

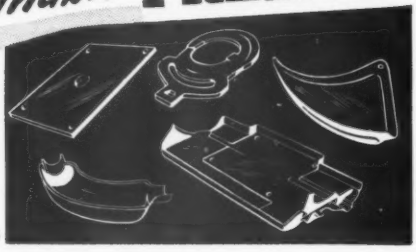

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We make a specialty of sharpening, reconditioning and converting broaching tools.

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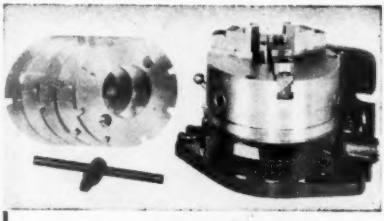

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So many different jobs can be done more economically with the Hartford Super-Spacer that it will pay you to investigate its possibilities for your shop. Standard equipment includes mask plates, reversible jaw self-centering chuck, sliding handle chuck wrench. It's moderate in cost. Write for illustrated applications bulletin.

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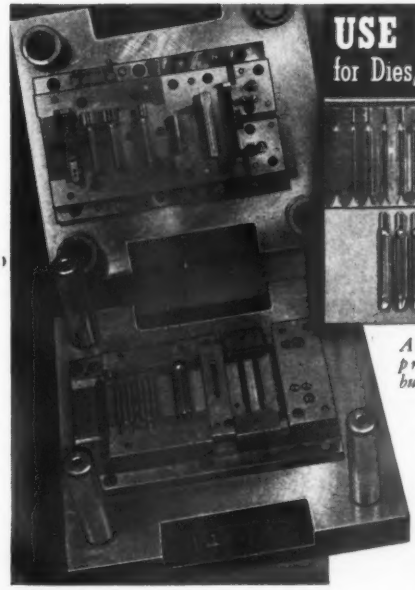

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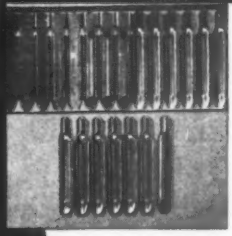

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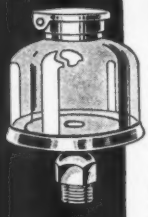
GITS
CLEAR-VISION UNBREAKABLE
OILERS



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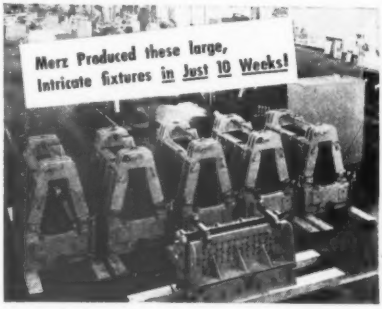

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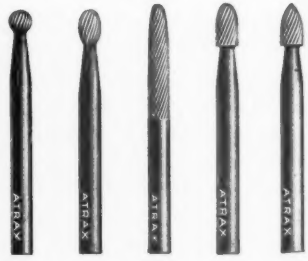
Precision Machine Ground

1/8" CARBIDE BURS

1½" long



D1 E1 H1 H2 K1

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ASK FOR BULLETIN A-51

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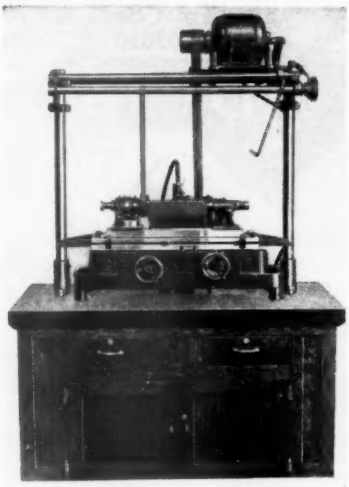

"At Recent Power Show, N. Y. C., two hundred sample gages were ground." Over one hundred tested under One Micro Inch Surface Finish with balance averaging one and one-quarter Micro Inch Surface Finish.

Gages were High Speed Steel using a 38220 K 9 BE Wheel.

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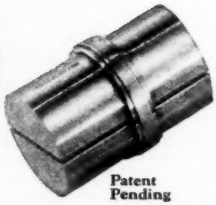
ASCO "AUTO-ARB" *can triple production on many secondary operations*

Automatically Expanding Arbor for holding work piece by inside diameter while machining outside surfaces.



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PERMITS CHUCKING and UNCHUCKING *WITHOUT STOPPING SPINDLE!*

Any machinable part can be held firmly by the inside diameter, for secondary operations, with the ASCO "AUTO-ARB". "AUTO-ARB" is a precision tool, expanding accurately, and maintaining perfect concentricity with the collet. No other tools are necessary—chucking and unchucking can be done without stopping the machine. Works equally well in "blind" holes, and requires a minimum of holding surface—eliminating the need for special arbors. Can also be used on drill presses or milling machines with collet devices.

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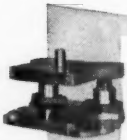
NEW SPEED and ACCURACY
WITH MICROLEX ANTI-FRICTION DIE SETS • • •



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Microlex Die Sets have ball or roller bearing guide pins which reduce die setter's time . . . enable you to get into production quicker . . . permit fast press speeds. Microlex Die Sets eliminate all down time caused by bound, scored or galled pins. Bearings have pre-load to prevent play between guide pins and bushings.

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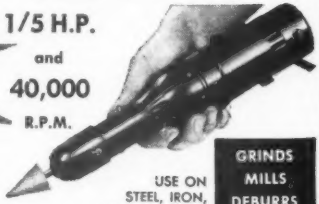

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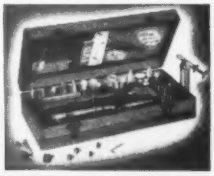

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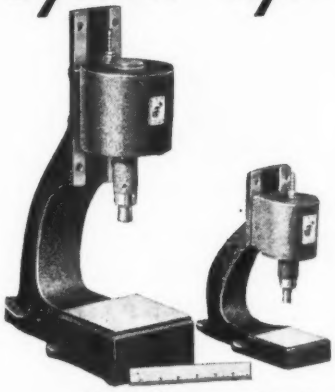

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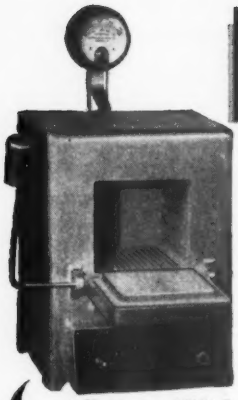

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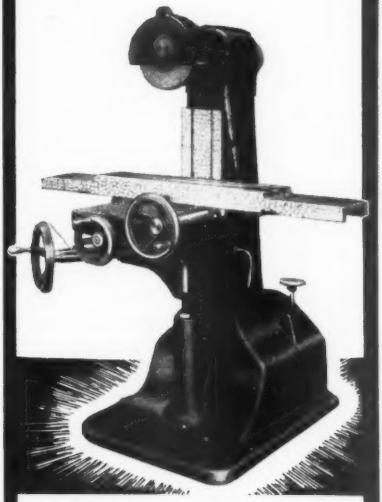

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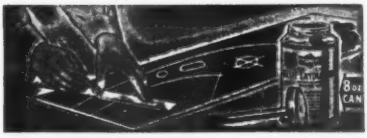

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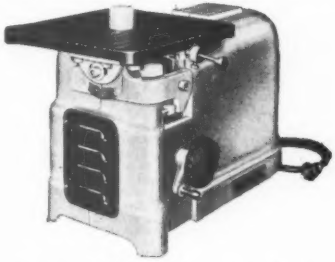

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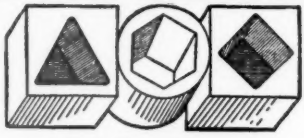

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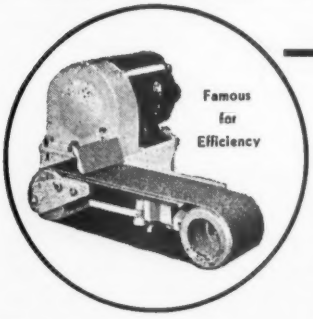

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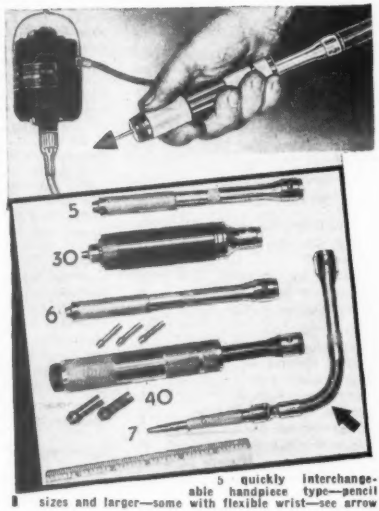

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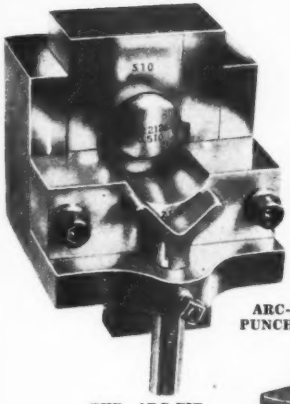
THE TUBE AND PIPE NOTCHING PRODUCTION TOOL



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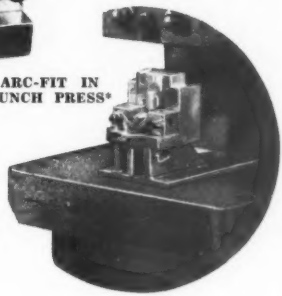

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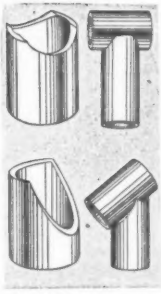

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- For any size pipe or tube
- Usable with hand or power press
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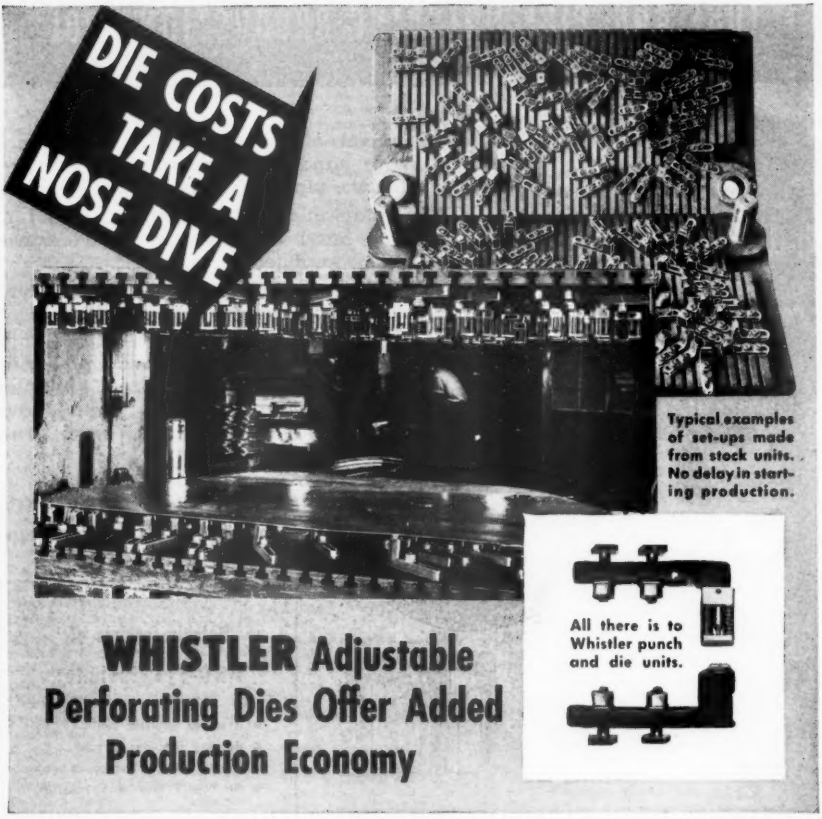
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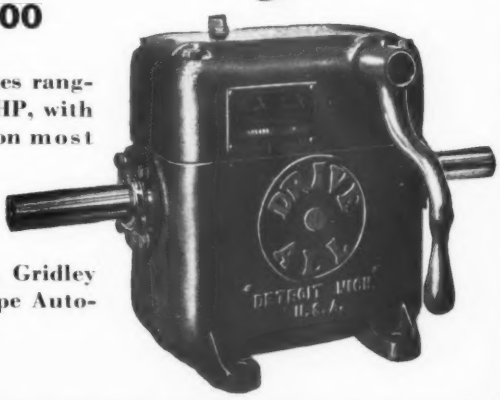

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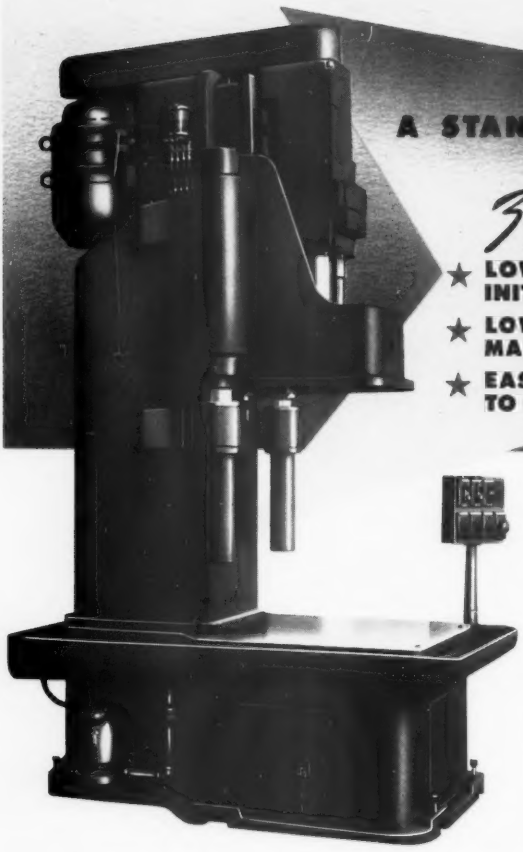

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